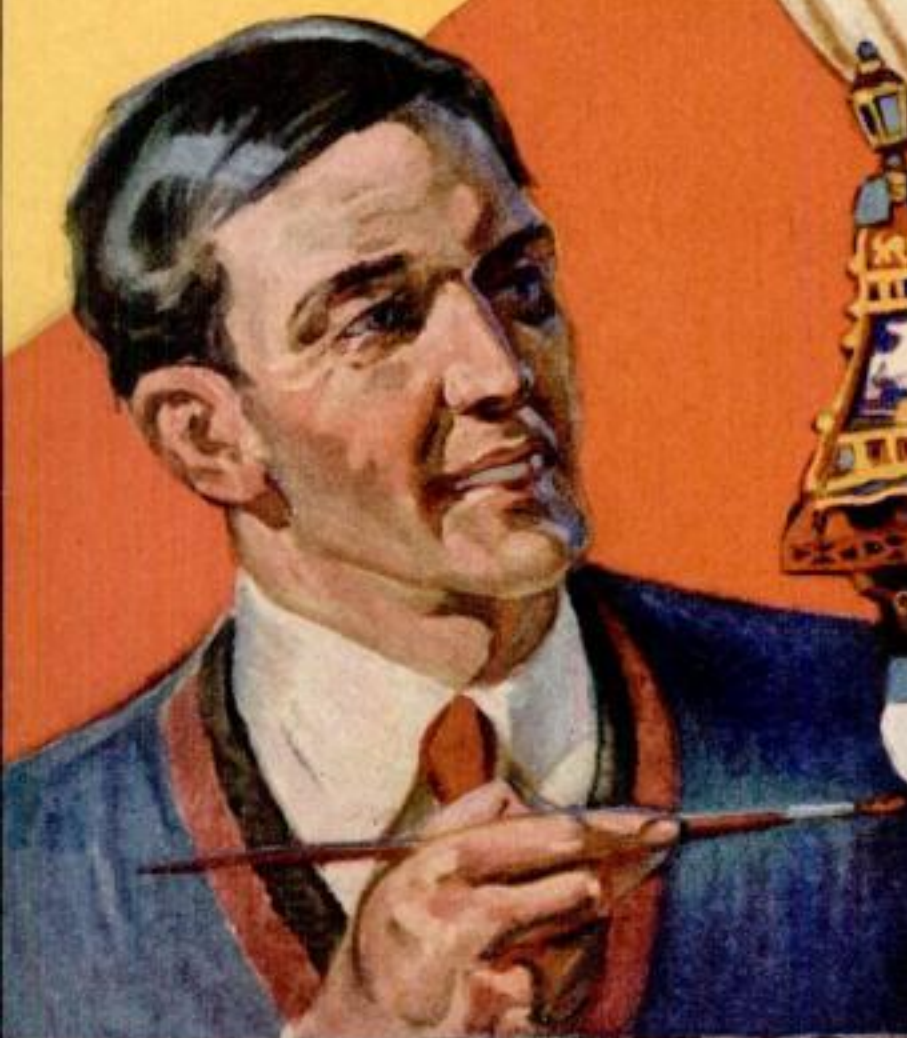


Popular Science

★ FOUNDED MONTHLY 1872

You can make
this ship model
at home for \$5

SEE PAGE 71



REMINGTON
SCHUYLER

\$1,000 IN CASH PRIZES EVERY MONTH

MAY

See Page 14

25 CENTS

Copyrighted material

Swing this trusty hatchet straight and true

WHAT you want in a hatchet,—the Plumb hatchet has—plus a wonderful safety device.

The tough, hard edge of this hatchet keeps its keenness — Plumb tempering methods are famous. The strength of the eye is assured by Plumb armor-plate heat treatment. And the head is hardened for husky work.

Balance and power for hard, deep cutting or for accurate, careful slicing. This blade goes where you send it!

And, whether new or old, your Plumb is safe to swing. For the Plumb Take-Up Wedge gives you a tight head always; a turn of the Wedge takes up any shrinkage in the handle.

You get these features in Plumb tools only. You get them by simply looking for the Red Handle and the Black Head.

Buy the trusty Plumb Hatchet — easy to find in any hardware store. Easy to swing straight and true!

FAYETTE R. PLUMB, Inc.
Philadelphia, U. S. A.

Look for the
Red Handle
WITH THE
Black Head
(Color Combination
Registered as
Trade Mark, U. S.
Pat. Off.)
EXCLUSIVELY
P L U M B



Instantly, with a turn of the wrist, you retighten the head of any Plumb tool. V-shape of wedge expands wood of handle against all sides of eye, all the way in.





The defender at the gates. Defective raw material "shall not pass" this alert tester. One reason why telephones are made right.

"They shall not pass~"

WITH this watchword of determination the French held back their foe at Verdun. Today "they shall not pass" is a watchword equally determined in Western Electric telephone making—only here it always means "defective materials and apparatus shall not pass."

Inspection, inspection, inspection is the order of the day in this work of making telephones and telephone equipment.

From the raw material stage, when strength tests and quality tests are rigorously applied, through every step of manufacture, a telephone must qualify for service—and do so before a chain of critical inspectors.

This insistence on high standards of materials and workmanship is Western Electric's day-to-day part in making Bell telephone service the standard of the world.



Back of
your
telephone



The acid test. The coating on a telephone must prove that it can resist corrosion.



A machine imitates the hand, lifting and replacing a telephone receiver. An endurance test.

Western Electric

SINCE 1882 MANUFACTURERS FOR THE BELL SYSTEM

Popular Science Monthly

The Magazine of Invention and Discovery

MAY, 1926; Vol. 108, No. 5
25 cents a Copy; \$2.50 a Year



Published in New York City at
250 Fourth Avenue

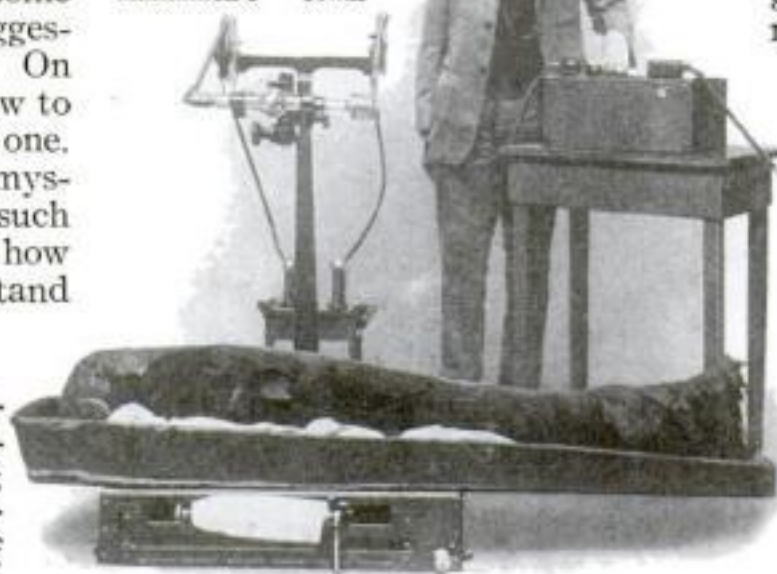
Don't Miss These Features

EVERY man who is at all interested in a home of his own—and who is not?—will find an immense amount of useful information on the subjects of home building and home keeping in our interesting articles by John R. McMahon. Each month this noted expert discusses in detail some vital problem of home ownership, giving valuable suggestions from his long experience. On page 28 of this issue he tells how to build a new home out of an old one. Next month he will explain the mysteries of architects' blueprints in such a way that you will be surprised how easy it is to read and understand them.

AND don't forget, there's another absorbing \$1,000 Picture Contest this month. Next month there will be still another one. In this unusual series of contests you have just as good a chance as anyone to win one of the big cash prizes—and you are sure of a lot of entertainment to

boot. Turn to page 14 of this issue and see how wide-awake you are.

With this X-ray apparatus, scientists now study ancient mummies without removing the wrappings. See page 38 for pictures of King Tutankhamen's coffin



OF THE many fascinating "How to make it yourself" articles which appear from month to month

in our Home Workshop Department, few have made our fingers so "itch to get at it" as Captain McCann's detailed description, beginning in this issue, of how to build the beautiful model of an old-time Spanish galleon, pictured on the cover of this issue. The constructional details which begin on page 71 will be concluded next month.

ONE of the finest works of handicraft to be found anywhere in the world has just come to light. It is the marvelous gold-engraved coffin of ancient Egypt's Pharaoh, Tutankhamen. Don't fail to look at the pictures of this magnificent sarcophagus on page 38. As you wonder at its intricate craftsmanship, you will realize how science, delving into forgotten ages, is enriching our knowledge of the world we live in. Every month POPULAR SCIENCE MONTHLY aims to give you new glimpses of the world's unfolding panorama.

In This Issue—200 Articles and Pictures, including

	Page
Popular Science Institute of Standards.....	6
Our 54th Birthday.....	9
The Greatest Sea Rescue.....	11
By Edgar C. Wheeler	
\$1,000 Prize Contest.....	14
The Typical American.....	16
He Lived Two Great Lives.....	17
By Robert E. Martin	
Now Come Oil-Electric Locomotives.....	19
A Game of Glorious Uncertainties.....	20
By George Lee Dowd, Jr.	
How Large Can a Star Be?.....	22
The World's Greatest Puzzles.....	23
By Sam Loyd	
Unique Radio Pen Makes Ink Copies.....	25
The Army and Your Boy.....	26
By Arthur Grahame	
How to Remodel an Old House.....	28
By John R. McMahon	
Only the Daring Work for Him.....	31
By Earl Chapin May	
Hungry Moths Cost Us Millions.....	33
By G. B. Seybold	
Planning the World's Largest Airship.....	34
By John K. Martin	

	Page
Can You Beat Them?.....	36
Where Movies Get Their "Props".....	37
Odd Bits from the Records of Science.....	38
Ancient Fossils with Life Forms.....	40
Giant Cranes in Record Feats.....	41
Stormproof Three-in-One Dirigible.....	42
Marimba Produced by Electric Fans.....	42
Storm Door from a Screen Door.....	42
Huge Dam to Form Mountain Lake.....	43
The Curious Side of Things.....	44
Cold Light Obtained with Liquid Lens.....	46
Women Skilful at Electric Work.....	46
Lock Has 1024 Combinations.....	46
Discarded Grindstones Make Fine Walls.....	46
Work While You Telephone.....	47
A Novel Swing for Children.....	47
Free Shade for Automobilists.....	47
Grass Catcher Fills Evenly.....	47
Giant Engineer Runs Miniature Train.....	48
Baseball Star Makes His Own Bats.....	48
Fine Violins Made in Home Workshops.....	48
He Made This Tractor Himself.....	49
A Noted Potter and His Kiln.....	49
Music Lesson Atop a Bridge.....	49
Capitol Gavel Maker.....	49

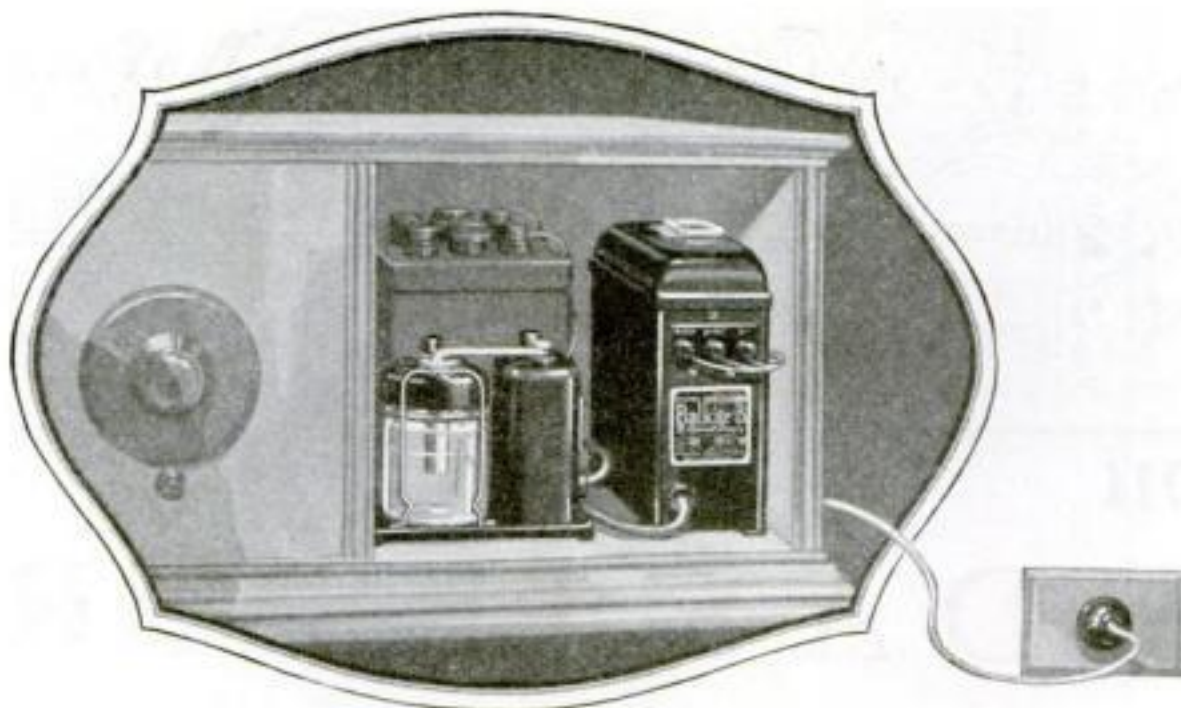
	Page
Making History in Aeronautics.....	50
When the American Eagle Is Captured.....	52
Strawberry Patch in a Barrel.....	52
Three Texas Lemons an Armful.....	52
"13" His Lucky Number.....	52
Fashions Mosaics from Egg Shells.....	53
How You Can Grow a Pearl.....	53
A Bedroom Set of Postage Stamps.....	53
How a Great City Protects Its Food.....	54
Boats for Land and Water.....	55
Progress of Science.....	56
Novel Devices Lighten Household Tasks.....	58
Prize Winners in Radio Contest.....	60
Radio—Here and There.....	62
How to Test Your B Battery.....	63
You Can Now "Turn on the Ice".....	64
Useful Additions to Your Car.....	65
How to Pick the Best Car.....	66
By Martin Bunn	
Newest Aids for the Autoist.....	68

Home Workshop.....	71
Better Shop Methods.....	76

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Chicago, Illinois. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright 1926, by the Popular Science Publishing Co., Inc. The contents of

this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, POPULAR SCIENCE MONTHLY does not underwrite the business methods of the individuals or concerns producing them. The use of POPULAR SCIENCE MONTHLY articles, or quotations from them for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.



Operate your present radio set from the light socket with Balkite "B" and a Balkite Trickle Charger



Balkite Trickle Charger

Converts any 6-volt "A" battery of 30 ampere hours or more into an automatic "A" power unit that furnishes "A" current from the light socket. With 4-volt and smaller 6-volt batteries may be used as an intermittent charger. Or as a trickle charger if a resistance is added to cut down the charging rate, \$10. West of Rockies, \$10.50. In Canada, \$15.



Balkite Battery Charger

The popular rapid charger for 6-volt "A" batteries. Noiseless. Can be used while the set is in operation. Special model for 25-40 cycles, \$19.50. West of Rockies, \$20. In Canada, \$27.50.



Balkite "B"

Eliminates "B" batteries and supplies plate current from the light socket. Keeps the "B" circuit always at full power. For sets of 6 tubes and less, \$35. In Canada, \$49.50.

Balkite "B" II

Will serve any standard set. Capacity 20 milliamperes at 135 volts. Especially adapted to sets of 6 tubes or more, \$55. In Canada, \$75.

The radio set you now own will operate from the light socket. No changes are necessary. You need only add Balkite "B" and a Balkite Trickle Charger.

Balkite "B"—the noiseless "B" power supply—replaces your "B" batteries entirely and supplies plate current from the light socket. The Balkite Trickle Charger keeps your "A" battery always at full charge, also from the light socket. If you like you may also purchase from your dealer an automatic switch that cuts out the charger and turns on Balkite "B" when you turn on the set.

This type of installation is the last word in radio convenience and ease of operation. You never have to operate your set on a weak power supply or worry about replacing

or recharging batteries. One turn of the switch and you have full, even power, exactly as required by the set. And because you always have full power you secure a quality of reception possible in no other way.

Both Balkite "B" and the Balkite Trickle Charger are entirely noiseless. Their first cost is the last. Both are permanent pieces of equipment with no bulbs, nothing to replace, break or get out of order. There is no further expense other than a negligible amount of household current.

Thousands of radio owners have already made this simple addition to their sets. You can make it too, and convert your set into a light socket receiver. Ask your dealer about it today.

FANSTEEL
Balkite
Radio Power Units

MANUFACTURED BY FANSTEEL PRODUCTS COMPANY, INC., NORTH CHICAGO, ILL.

Sole Licensees in the United Kingdom: Messrs. Radio

Accessories Ltd., 9-13 Hythe Rd., Willesden, London, N. W. 10



Do You NEED A SELF-STARTER?

Success— *Do You Know the Way, and How to Get Started?
Here is How Some People Found Out*

EVERY MAN wants to be successful; not every man is. Very often, it is the lack of a start that keeps a man back—the knowledge of HOW to get ahead.

We all read stories of how men have succeeded, but many of these discourage rather than help us. It seems as if these men have so much greater ability, so many more opportunities than we have. We don't stop to think of how they improved that ability, and how they learned to grasp those opportunities. Obstacles are in every man's way—it's the man who learns to step over them that wins.

Your obstacle may be lack of specialized knowledge in your own field of work. Then you will be interested in this very definite letter that tells how one man learned "how." It brought Mrs. A. Lundeen of Forest Lake, Minnesota, the first prize of \$50 in POPULAR SCIENCE MONTHLY's contest, last month.

Contest Editor:

Among the numerous graduates of the Coyne Electrical School, I think my friend and relative is the one most satisfied.

Here is the reason. Before taking the course he was receiving \$35 a week. Now he is receiving \$700 a month, or an increase of 500 per cent. This raise in salary took place during the last four years and will very likely keep on for some time.

Under those conditions, most anyone would be satisfied.

MRS. A. LUNDEEN

Your road to success may be along a different route than this man's, but the Money-Making Opportunities Section of POPULAR SCIENCE MONTHLY offers suggestions for 83 different ways.

And it is finding the way, and getting started, that counts. Aims and ambitions are fine things to possess; they are as essential to you as the engine is to a car. The thing to be sure of, however, is that your ambitions are not deteriorating into mere *wishes* (the upholstery of the car, that is comfortable but doesn't get you anywhere).

Here is the story of a man who started his engine and made his car GO!

Contest Editor:

The advertisement of the International Correspondence Schools in the March issue of POPULAR SCIENCE brought to my mind a very good example of how much these schools can do for a man who has not had the advantages of higher education.

This man that I write of had not even had a high school education and he held a position where he really needed more advanced training. Realizing his deficiencies, he enrolled in a course of Business Management and studied diligently.

The results of this course showed almost from the start and it was not long before he began to advance up the ladder. His promotions were rapid until now—only about ten years after his enrollment—he is President and General Manager of that same firm with which he started in a lowly position. He has also held the Mayor's chair in his home city. Surely a wonderful result of their training.

CLARENCE M. MINOTT,
Bangor, Maine

President, General Manager, and Mayor—these are surely titles that are in the back of every ambitious mind. This man wasn't content to leave them there, though, but found the road to realization. For the letter describing his ascent was awarded the second prize of \$25.

To help its readers find their "roads," POPULAR SCIENCE has

grouped together all the advertisements that offer suggestions, in a Money-Making Opportunities Section that you will find on pages 116 to 142 of this issue. Advertisements of courses of training, residence schools, technical books, sales agencies, patent attorneys, and advertisements of a similar nature will be found there.

It may be that, a year from now, this section will bring to your mind thoughts similar to Mr. Herdtfelder's. Here is his letter that won him the third prize of \$10 in last month's contest.

Continued on page 116

\$100 in Cash Prizes

For the best letter in answer to the questions:

What advertisement in the MONEY-MAKING OPPORTUNITIES SECTION interests you most—and why?

we will pay \$100 in cash prizes.
For full details—

See Page 116

83 Short Cuts to Success

**[SEE PAGES
116-142]**

Radiotron UX-199 **Radiotron UV-199**
 the same tube but with dry cell tube for both de-
 the new standard base. tecton and amplification.



Low in cost to run

*I*T'S the special filament of an RCA Radiotron UV-199 (or UX-199) that makes it cost so little to run. This tube draws so little current that for a limited time it can even be operated from flashlight batteries—for your portable sets! It never needs more than inexpensive dry batteries—and it uses them up slowly.

The thoriated filament of this tube is specially treated, so that there is always a layer of thorium a single atom deep on the filament-surface. And electrons leap from the thorium at a stupendous rate—conveying the music and the speech.

Because this type of filament gives off more electrons at less heat—it lasts longer, and it uses less battery current. And because this type of filament was developed in the great research laboratories that contribute to RCA, you will find it in every genuine RCA Radiotron UV-199 and UX-199. Another good reason for being careful to find the RCA mark on the base when you buy!

®

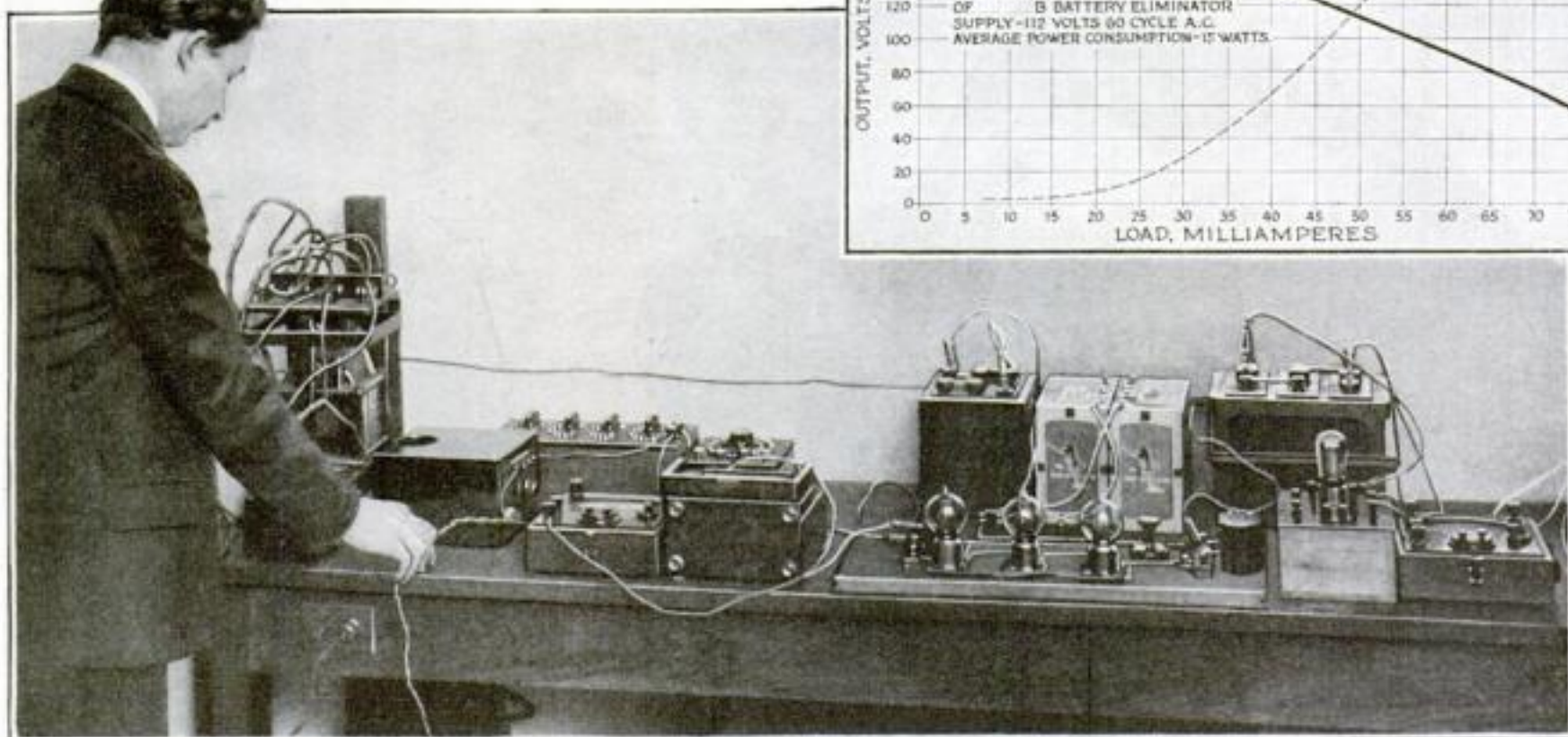
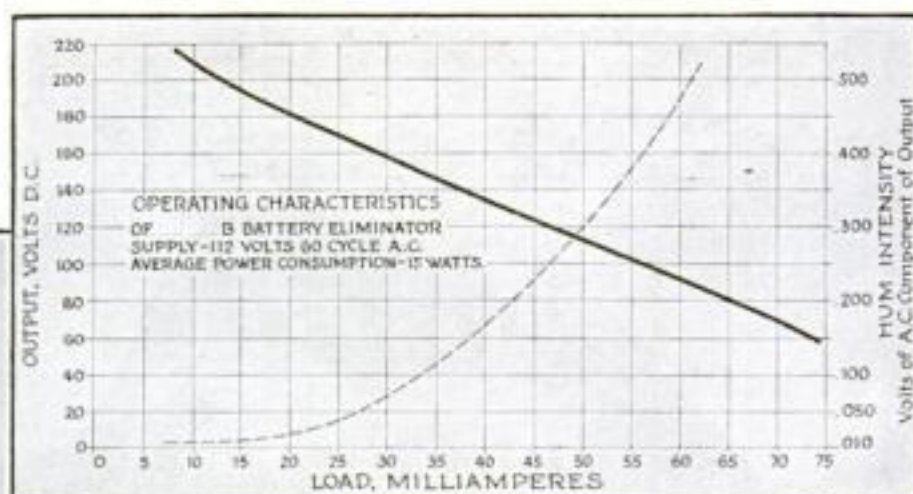
RADIO CORPORATION OF AMERICA
 New York Chicago San Francisco

RCA Radiotron

MADE BY THE MAKERS OF RADIOLAS

If It Passes These Tests, It Is Worth Buying

A battery eliminator is here undergoing test. The apparatus shown permits an accurate determination of its characteristics. Actual curves showing the hum intensity are obtainable



JUDGING by the hundreds of letters we have received at the Institute on the subject, there is more interest in—and more *doubt* about—battery eliminators than any other type of radio equipment on the market.

An *efficient* eliminator is, without question, a worth-while addition to a radio outfit. A *poor* eliminator will ruin an otherwise satisfactory outfit. And that a large proportion of the eliminators on the market are inferior is proved by the fact that the Popular Science Institute of Standards has had to disapprove after test more products under this classification than any other.

The "hum" and other objectionable features that are found in so many eliminators are not to be found in the eliminators approved by the Institute. Following are the characteristics that a B eliminator must possess to merit the approval of the Institute:

1. Sufficient capacity, so that it may maintain its output d. c. voltage at its rated value when used with standard receiving set using five or more tubes.
2. Reasonably good inherent "voltage regulation" or a manual control of "output voltage," for voltage adjustment.
3. The rectifying element must give a reasonably long, useful service.
4. The construction must be such as to insure continuous operation with

By ALEXANDER SENAUKE, E. E.
Radio Engineer.

Popular Science Institute of Standards

freedom from breakdown, fire hazard, or electric shock.

5. The filter effectiveness must be sufficient to make its operation, when

POPULAR SCIENCE
Monthly
Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in **POPULAR SCIENCE MONTHLY** may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by **POPULAR SCIENCE MONTHLY**.

THE PUBLISHERS.

properly installed, free from disturbing hum or other line noise.

Eliminators that are submitted for test to the Institute are tested by specially devised test methods to check their conformance to these five characteristics.

Characteristic No. 5 is a major prerequisite for all battery eliminators. In testing the "filter effectiveness of B battery eliminators," in the radio laboratory of the Institute, the various conditions of operation are simulated by variable resistors and measuring instruments. For each condition, the "alternating" or "hum producing" component of the output of the eliminator is separated and impressed upon a special, calibrated amplifier and vacuum tube voltmeter device that amplifies this alternating component to an even greater extent than it is normally amplified in a receiving set, and permits of its being measured on an electrical meter. The reading of this meter, therefore, gives a quantitative indication of the amount of "hum" that the eliminator will produce when used to operate a receiver.

Readers who are planning to buy a B eliminator will undoubtedly be interested in the list of approved radio and tool products that can be obtained free of charge by writing the Popular Science Institute, 250 Fourth avenue, New York City.



Confidence

Confidence in that uninterrupted service you expect from your radio means belief that there is unusual *quality* behind the dials—in design, in materials, in workmanship.

ALL-AMERICAN furnishes many guarantees of such quality. But the best of guarantees, for an experienced buyer, is the knowledge that a noted organization of specialists in fine radio, equipped with every facility for creating excellence, stands sponsor for the product.

IS

All-American Model R: a five-tube tuned-radio-frequency toroid receiver, Rauland-Lyric-equipped. Price \$90 (West of the Rocky Mountains \$95)

The leading wholesaler of radio apparatus in your community has probably been for years an ALL-AMERICAN Authorized Distributor. ALL-AMERICAN Guaranteed Radio Products are sold everywhere by responsible and reliable dealers.

ALL-AMERICAN RADIO CORPORATION
Pioneers in the Industry E. N. Rauland, Pres.
Belmont, Tripp and Kenosha Avenues, Chicago, U. S. A.



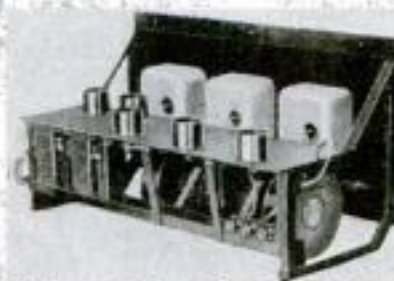
The Laboratory



The Test Room



The Factory



The Steel Chassis



MEMBER
RMA

OWNING AND OPERATING STATION WENR—266 METERS

ALL-AMERICAN

Radio Built for the Years to Come



"The little wrinkle that makes my 'B' batteries last longer is using the right size Evereadys with a 'C' battery"

"I USED to think that because the Eveready 'B' Battery No. 772 cost less than either of the larger Heavy Duty Evereadys that I was saving money. As a matter of fact, on four or five tube sets, that was false economy.

"The right size Eveready 'B' Batteries to use depends on the number of tubes in your set. The life of the batteries depends on how much you listen in and on whether a 'C' battery is employed."

To get the maximum of "B" battery life and satisfaction, follow these simple rules:

On 1 to 3 tubes—Use Eveready No. 772.

On 4 or more tubes—Use the Heavy Duty "B" Batteries, either No. 770, or the even longer-lived Eveready Layerbilt No. 486.

On all but single tube sets—Use a "C" battery.*

Follow these rules, and No. 772, on 1 to 3 tube sets, will last a year or more; Heavy Duties, on sets of 4 or more tubes, eight months or longer.

The average year-round use of a set is two hours a day. If you listen longer,

your "B" batteries will have a somewhat shorter life. If you listen less, they will last longer.

Our new booklet, "Choosing and Using the Right Radio Batteries," is free for the asking. It also tells about the proper battery equipment for the new power tubes.

*NOTE: In addition to the increased life which an Eveready "C" Battery gives to your "B" batteries, it will add a quality of reception unobtainable without it.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
New York San Francisco
Canadian National Carbon Co., Limited
Toronto, Ontario

Tuesday night means Eveready Hour—
9 P. M., Eastern Standard Time, through
the following stations:

WEAF—New York	WGR—Buffalo	WGN—Chicago
WJAR—Providence	WCAE—Pittsburgh	WOC—Davenport
WEEI—Boston	WSAI—Cincinnati	WCCO—Minneapolis
WTAG—Worcester	WEAR—Cleveland	WCCO—St. Paul
WFI—Philadelphia	WWJ—Detroit	KSD—St. Louis



LEFT — No. 486, for 4, 5 or more tubes. \$5.50.



RIGHT — Eveready Dry Cell Radio "A" Battery, 1½ volts.

EVEREADY
Radio Batteries
—they last longer

1872



1926

OUR 54TH BIRTHDAY

AN EDITORIAL

POPULAR SCIENCE MONTHLY is 54 years old with this issue; not a bad age—for a man or a magazine. And yet at 54, birthdays have a way of following each other so closely that one is apt to slip by unremembered.

So it might have been with us this year, but for Edward S. Pattison, student of engineering at Rensselaer Polytechnic Institute, Troy, N. Y. From Mr. Pattison, born thirty-odd years after POPULAR SCIENCE MONTHLY, came a note of appreciation of the help the pages of this magazine have given him in selecting his life-work. With the note came a copy of POPULAR SCIENCE MONTHLY for May, 1872, the first issue ever published. The magazine had been in the family library more than half a century.

Those today who are making POPULAR SCIENCE MONTHLY had nothing to do with the magazine of 1872. Most of us were yet unborn. But Mr. Pattison's letter, and others like it, prove to us that our trail has been straight; our progress true. In that first issue of ours, Edward Livingston Youmans, the blind genius and founder of POPULAR SCIENCE MONTHLY, wrote of its purpose:

"Science is not the mystery of a class, but the common interest of rational beings, in whom thinking determines action.

"It is this immense extension of the conception of science, in which all the higher subjects of human interest are now included, that gives it an everlasting claim on the attention of the public. Besides its indispensable use in all avocations, and its constant application in the sphere of daily life, it is also profoundly affecting the whole circle of questions, speculative and practical, which have agitated the minds of men for generations.

"Whoever cares to know whither inquiry is tending, or how opinion is changing, what old ideas are perishing, and what new ones are rising into acceptance—briefly, whoever desires to be intelligent as to contemporary movements in the world of thought, must give attention to the course of scientific inquiry.

"Believing that there are many such in this country, the POPULAR SCIENCE MONTHLY has been commenced with the intention of meeting their wants more perfectly than

any other periodical they can get. POPULAR SCIENCE MONTHLY will make its appeal not to the illiterate but to the generally educated classes. Our pages will be adapted to the wants of these and will enable them to carry on the work of self-instruction in science."

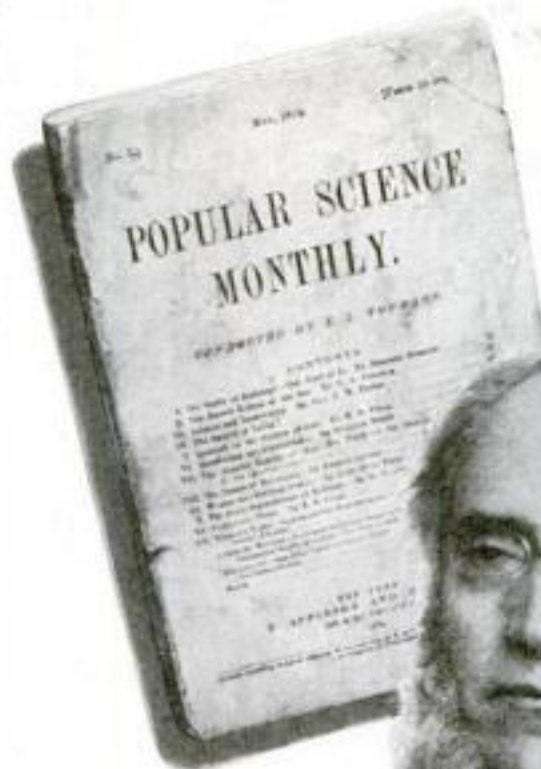
Year after year those policies have guided the editors of POPULAR SCIENCE MONTHLY. That old purpose is in the planning of every issue. And instead of the few hundred readers of 1872, we now have hundreds of thousands in every part of the world.

POPULAR SCIENCE MONTHLY is conducted today just as it was fifty-four years ago, but the fields of science and the interests of mankind are seen to be far wider than even Mr. Youmans dreamed of half a century ago. From thousands of laboratories and factories and shops have come inventions and discoveries to make the daily life of human beings easier, richer, happier.

And to keep pace with this tremendous progress, POPULAR SCIENCE MONTHLY has been enlarged and improved. Where one man once made the magazine, it now needs many. A large board of editors and consulting scientists, our own laboratories and testing divisions, and an extensive research department, all contribute to the services offered our readers.

IT IS the function of POPULAR SCIENCE MONTHLY to report and interpret great advances—to explain just how they affect you and me. Pictures have been added to make vivid the tremendous drama of science and its effect on civilization and the lives of men. And that we may be of service to the largest possible number of people, we have reduced the news of science to words that any intelligent person can understand without effort. We have forced those exclusive folk—the scientists—to share the knowledge, once shared only with each other, with all of us.

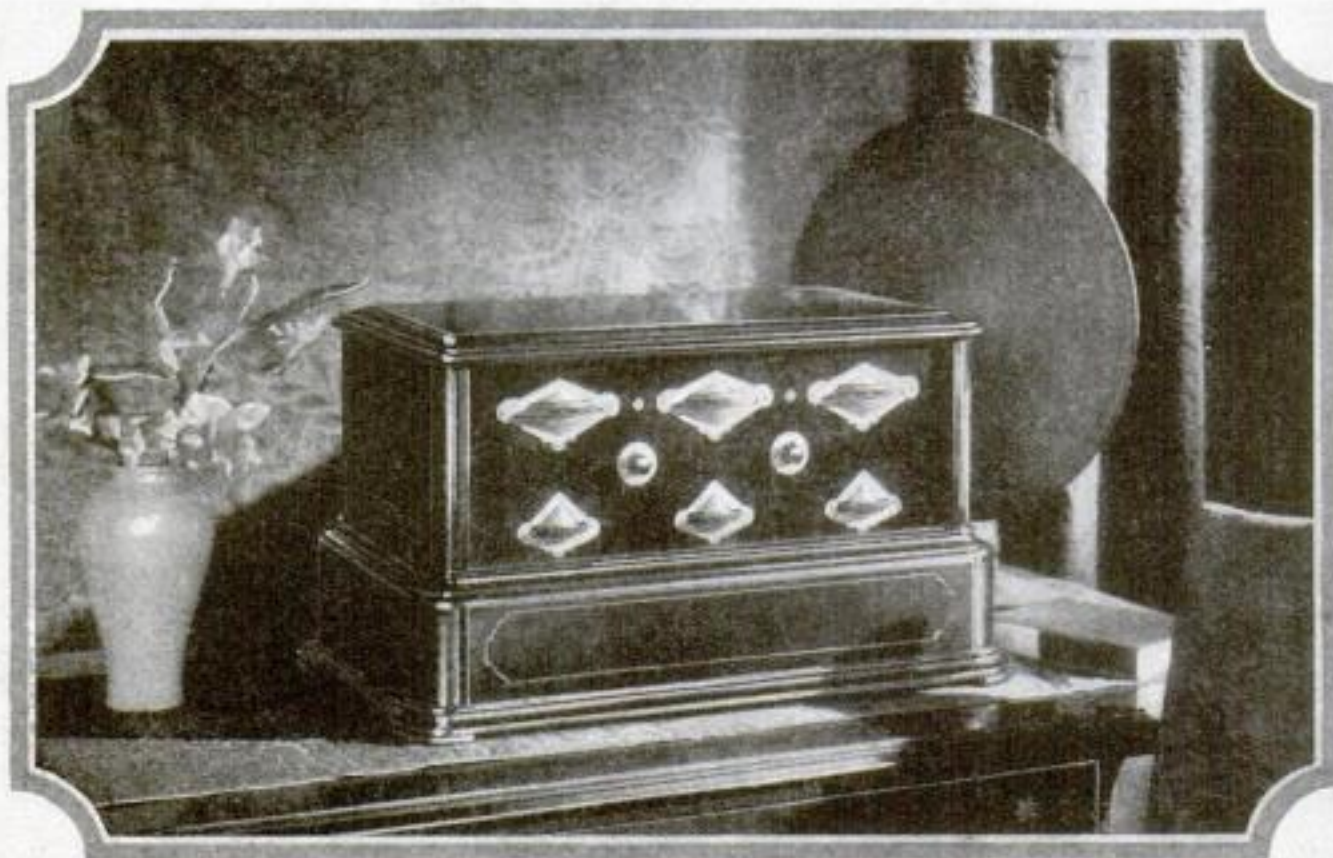
On this our fifty-fourth birthday we have reason to be proud of no one accomplishment more than that the high priesthood of science is no more. Science has been made graphic, understandable and interesting to the average man and woman. We have kept the faith of our founder.—S. N. B.



In May, 1872, Edward Livingston Youmans, the blind genius who founded POPULAR SCIENCE MONTHLY, published the first issue of this magazine, a reproduction of which is presented above



Our Founder and His First Issue



Why the Synchronphase Appeals to the "Fan"

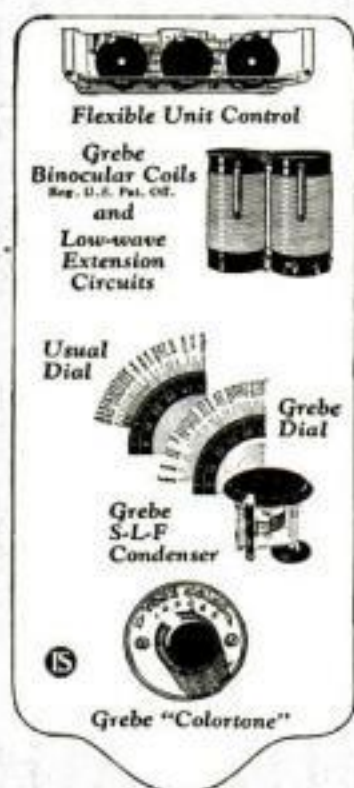
HE, more than any one else, understands what Grebe quality means. He best realizes why Grebe construction is reflected so surely in the superior reception of the Synchronphase.

The Grebe Synchronphase, built to satisfy the "fan", has quickly won first place in the opinion of the average radio user.

*Ask your dealer to show you
what Grebe reception means.*

A. H. Grebe & Co., Inc., 109 West 57th St., New York
Factory: Richmond Hill, New York
Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

This Company owns
and operates stations
WAHG and WBOQ;
also low-wave re-
broadcasting stations,
mobile WGMU and
marine WRMU.



All Grebe apparatus is
covered by patents
granted and pending.

The GREBE SYNCHROPHASE

TRADE MARK REG. U.S. PAT. OFF.

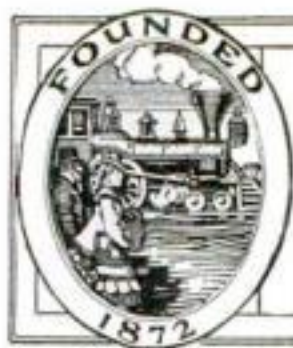


It is written:

"A perfect vase never
came from a bad
potter's wheel."

When one realizes its
origin, the superior re-
ception of the Synchro-
phase is not to be won-
dered at.

Doctor Hux



An Untold Story of The Greatest Sea Rescue

With the life-saving apparatus helpless against the fury of an angry ocean, the *Roosevelt's* engineers invented ingenious devices to save the stricken crew of the sinking *Antinoe*

By EDGAR C. WHEELER

TWENTY-FIVE half frozen and starving seamen clung desperately to the storm-swept deck of the sinking tramp steamer *Antinoe*. Boats were gone; engines and fires were flooded; and the lee rail was dipping under. Numbed hands grasped for hold against mid-Atlantic, gale-driven combers that surged up angrily to lap them into the sea. Voices that tried to shout were lost in the howl of winds and driving sleet.

Two hundred yards away was the dim outline of a ship. For three days now, the United States liner, *President Roosevelt*, had stood by. For three days the rescuers had tried every resource known to mariners in frantic efforts to reach them.

To the huddled group on the derelict, it seemed as if the full wrath of the "Roaring Forties" must surely carry them to death.

Suddenly, above the storm, came the faint booming of a gun. A thin rope slapped down across the careening deck. The stricken seamen seized it eagerly, with new strength. Together they tugged at it. As they pulled, an empty lifeboat, at the end of the line, moved slowly toward them across the foaming sea. Now it was 100 feet away; now only twenty feet. A little more, and the boat's stout painter, to which the thin line was made fast, would be within their reach. One final frantic tug, then . . . The rope fell slack in their hands. The line had parted.

Everyone knows what happened then; how, a few hours later, the entire crew of the *Antinoe* finally was taken off in boats manned by heroes of the *Roosevelt's* crew. The whole world was stirred by this magnificent rescue, and two continents vied in honoring Captain Fried and his men



Faced by Emergency, He Became an Inventor

John Turner, chief engineer of the United States liner *President Roosevelt*, who met one of many emergencies in the thrilling rescue of the *Antinoe's* crew by inventing what has proved to be an important improvement in apparatus for saving lives at sea

for their victory in that grim four-day battle with a thundering tempest.

But behind the shooting of that one life line after a dozen other attempts had failed—even while it brought only heart-rending disappointment—lies a remarkable chapter in the story of the rescue, a

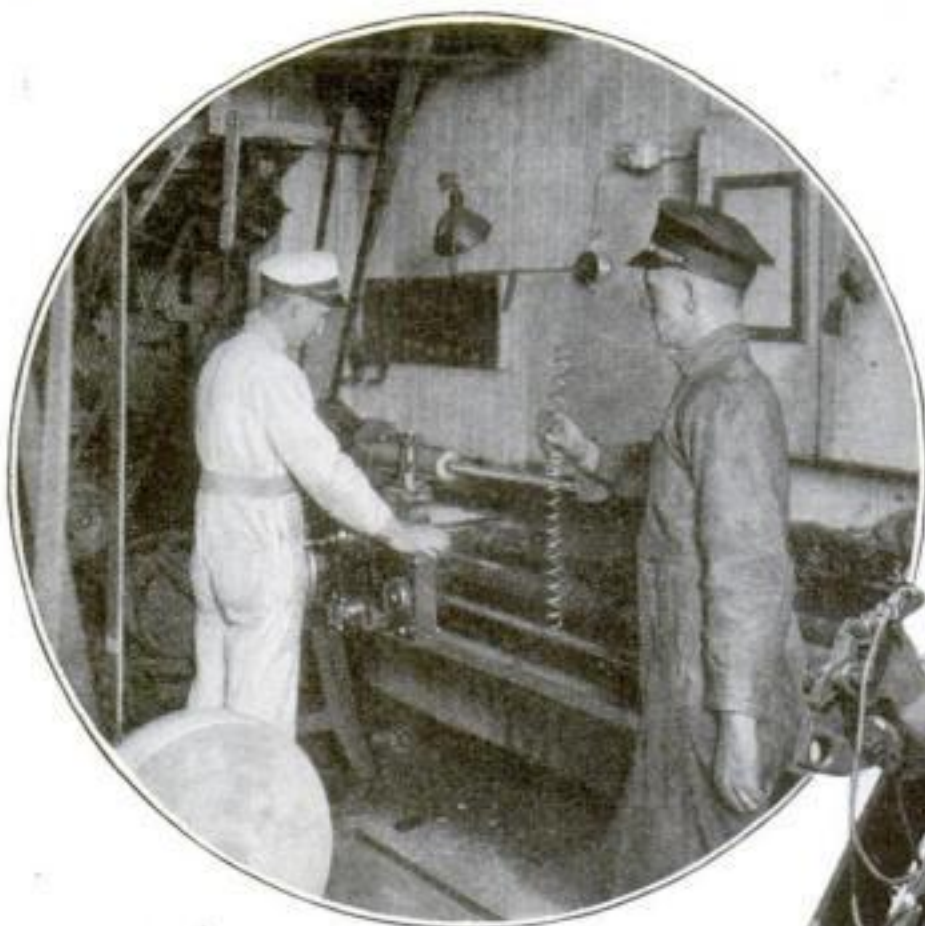
chapter which until now has remained virtually untold. It is a story of ingenuity and resourcefulness seldom equaled; of men trained to do things and make things with their own hands, who in a few tense hours became inventors and mechanical geniuses to meet a great emergency. Its heroes were below-deck heroes—stout-hearted engineers, machinists and firemen, begrimed with the oil and grease of machinery, who labored hour after hour in the din of the straining engines to make the rescue possible.

WHILE Captain Fried maneuvered his ship perilously close to the foundered *Antinoe*, jockeying for positions of vantage, it was the sure hands of engineers on the throttles down below that sent the *Roosevelt* plunging forward at his bidding, or pulled it up sharply on its haunches. In those four days of maneuvering, they responded to more bells from the bridge than ordinarily are sounded in two years in and out of port.

While heroes above were risking and losing their lives in futile attempts to launch their lifeboats, the hands below were skilfully putting thousands of horsepower through one of the most terrific tests that marine engines ever have been called upon to meet. Time and again, turbines, whirling 1800 revolutions a minute, were thrown from full speed ahead to full speed astern. Yet never once were the

great engines allowed to falter.

Again, when the first shot lines from the Lyle life-saving gun snapped in mid-air, and the supply of projectiles was exhausted, it was the engineers who turned to the machine shop and there fashioned new projectiles from rough steel.



Below-Deck Heroes

At the left, First Assistant Engineer Ganly making new projectiles for the Lyle gun in the *Roosevelt* machine shop as he did while the sea waited for its victims. Second Engineer O'Toole stands by, ready to attach the wire spring

man who during the war had charge of installing engines on twenty-five American torpedo boats; James O'Toole, senior second; Joseph Dluzon, junior second; and Bernard Duffy, third—all of them skilled engineers and expert machinists as well.

These were the men Captain Fried counted on to carry through when, that Sunday morning in January, he received the S O S of the *Antinoe* and summoned his chief engineer to the bridge. Through driving hail and snow the *Roosevelt* was laboring. Heavy seas were dashing foam across her decks. The prospect of a rescue in such a storm was enough to dishearten even the bravest of men.

"WE ARE going to her," Captain Fried told his engineer. "We'll want all the speed we can get, and we'll need all hands on duty."

Down below went out orders for double watch. Sleeping men tumbled from their bunks and hurried down steep iron stairways winding into the engine room, twenty feet below the water line. Yellow jets of flaming oil spat and roared under the boilers, throttles were opened wide, and the *President Roosevelt*, guided by radio compass, churned to the rescue with all the power that was in her.

At noon the *Antinoe* was sighted. The *Roosevelt* stood by to the windward, while ballast pumps poured oil on the foaming waters. Two hours later the Lyle gun, devised for just such a rescue, was made ready on deck to fire the first shot line to the *Antinoe*.

This little mortar, about a yard long, points its two and one half inch muzzle sharply upward. The entire gun is stationary on the deck, so that it is necessary to aim the ship instead of the weapon. Its projectile is a steel bullet a foot long, into one end of which is fastened a slender steel rod or spindle. This spindle ends in a wide eye in which is fastened the end of a manila rope, about the thickness of an

And finally, when these shots failed like the others, it was the chief engineer, John Turner, who met the emergency with a simple but effective invention, inspired by the necessity of the moment. At the very first trial, the improved projectile which he devised carried the life line squarely across the deck of the *Antinoe* and a quarter of a mile beyond.

How this line, when hitched to an empty life-boat, severed across the icy rail of the *Antinoe*, already has been told.

Yet even though it did not lead directly to the saving of lives, the great fact remains that in the most critical moment in one of the most thrilling of all sea rescues there was invented an important improvement in apparatus for saving lives at sea—the inspired idea of a handyman.

And the *President Roosevelt's* chief engineer is just that—a handyman. A slightly built, soft-spoken, reticent man of 37 years, he has been making things with tools and machines ever since he was fifteen, an apprentice in a machine shop.

AS A boy, his greatest pleasure in spare hours was to build toy steamships with real toy engines, and make them run. As a man, aboard ship, his hobby has been the making of handy devices—among them such things as an ingenious wave-driven pump that automatically bales a small boat at anchor; a quick-heating kettle that boils the morning coffee in a minute; a centrifugal machine gun driven by a gas engine; a device for measuring the distance of airplanes with beams of light.

And, with all, he is a master engineer, trained in an English university, and in the rougher school of experience. During the World War he made ninety-six trips through the submarine zone. Many times



Two Simple Changes That Improved a Noted Invention

Above, the Lyle gun, loaded with the emergency-born projectile, ready to be fired. Below, the new projectile, showing original eighteen-inch spindle (marked by dotted circle) lengthened to four feet, with Turner's spring

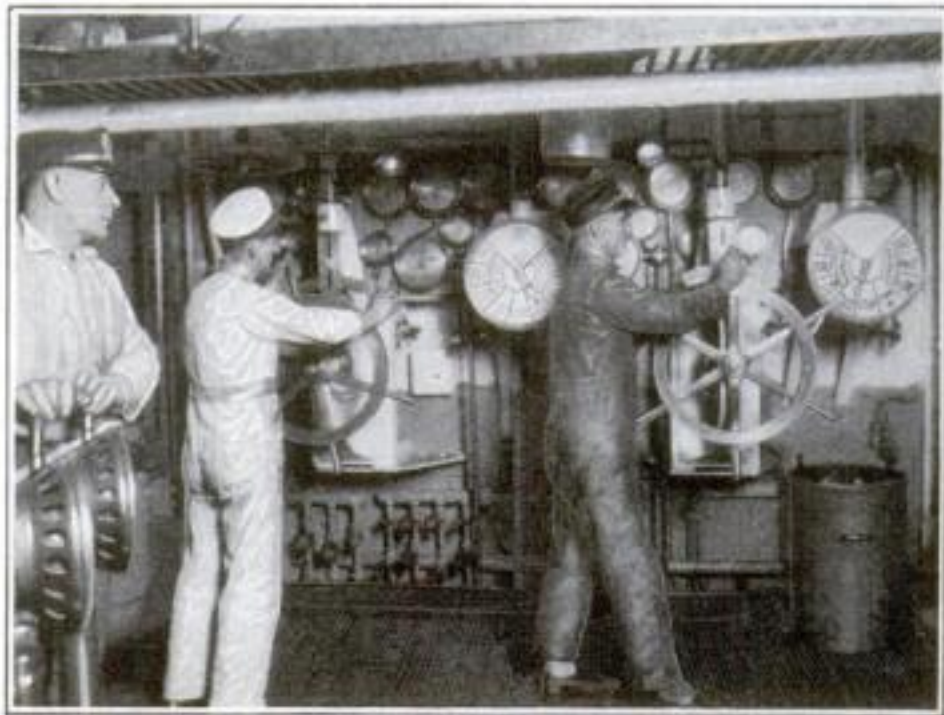
his resourcefulness and inventive ability have been put to the test.

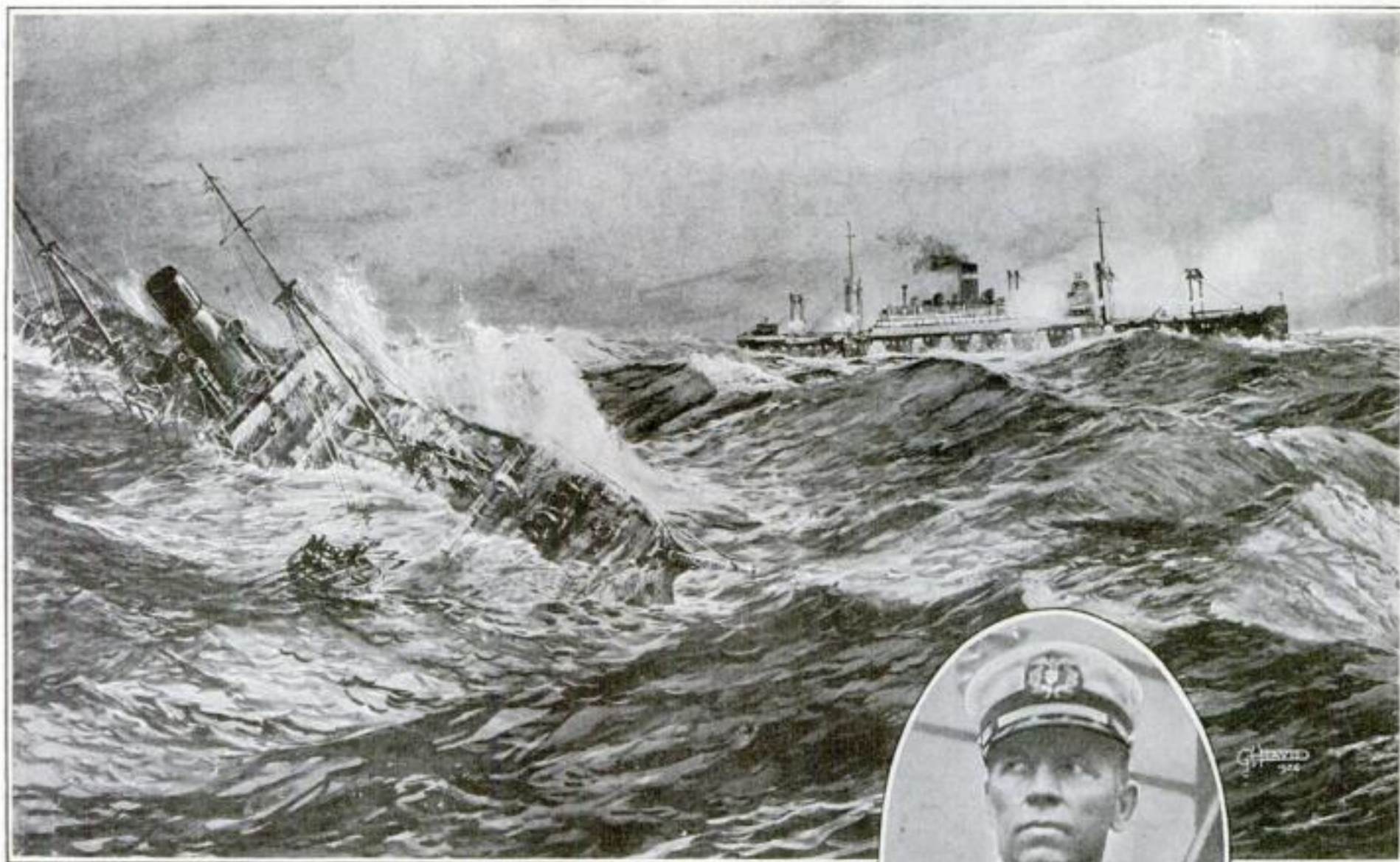
Once, for example, when the sixteen-inch piston of the *President Roosevelt's* steering engine broke, he quickly improvised a new piston from the lifting gear for a high pressure turbine. At another time, on the steamer *Philadelphia*, a broken main crankshaft found him not at all at a loss. He simply divided the power plant in half, and drove his ship with half a crankshaft, with two engines instead of the four.

His four assistant engineers on the *Roosevelt* are men of much the same caliber: James Ganly, first assistant, a young

Made Rescue Possible

The engine room of the *Roosevelt* showing dials flashing orders from the bridge during the thrilling rescue. At the extreme left Third Engineer Duffy is seen relaying the orders to the fire room. At the wheels are Ganly and O'Toole





The Final Scene in the World's Most Thrilling Sea Rescue

In this drawing, our artist has graphically shown the approach of the *Roosevelt's* lifeboat to the doomed *Antinoe* to take off the remaining thirteen of her crew. The picture was made from descriptions of passengers and the crews of both ships. The *Antinoe* had listed to an angle of forty-five degrees, and its crew were huddled about the foremast



Captain Fried of the *President Roosevelt*, who directed the famous rescue of the British crew

ordinary clothesline, coiled in a large bucket at the side of the gun. The projectile is inserted in the gun with the spindle and line protruding from the muzzle. A charge of powder set off by a primer fires it.

And now, while searching eyes on the bridge peered through the dark curtain of sleet, seeking aim at the half obscured mark, the engineers below were responding to bells which kept sounding in quick succession as the tossing ship maneuvered into position. With gaze fixed on the dials that indicated orders telegraphed from above, and with hands clutching the engine control wheels, they moved with clocklike precision to the commands of pointers that told them: "slow"—"full ahead"—"stop"—"reverse."

THE little gun boomed. But as the projectile sped from the muzzle, it left the rope behind! The quick, lashing jerk of the bullet had snapped the rope like so much thread! A second shot, then a third, met with like failure. "All three projectiles gone," was the word passed down from the deck.

"We'll make some more," the chief engineer flashed back.

A few quick measurements, and he hurried into

the ship's machine shop, just off the engine room. There, from a stock of steel bars, he selected one of the correct diameter and cut it to length for a twelve-inch bullet. For the spindle he turned down a length of boring bar, threaded it at one end, and inserted it in a threaded hole bored in the projectile. On the other end of the spindle he welded an eye. In the short space of half an

hour the job was entirely completed.

Through the night and the next morning, while the *Roosevelt* drifted about in search of the *Antinoe*, which had been lost in the darkness, the engineers worked without rest by turns in the machine shop,

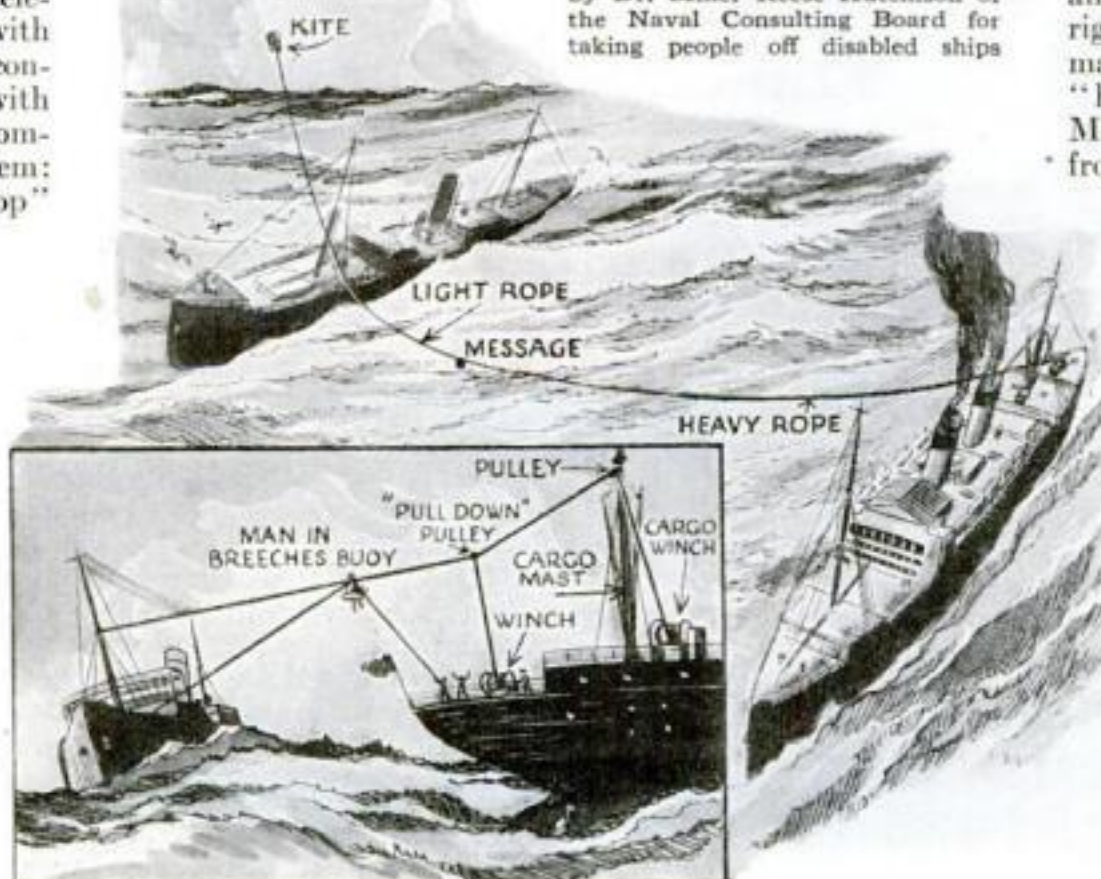
making projectiles. When the stock of two-and-one-half-inch bars was exhausted, they took three-inch stuff and turned it down to the right thickness. In all, they manufactured thirteen of the "homemade" projectiles. Meanwhile, other mechanics from the engine room had turned electricians and were stringing thousand-candle-power lights around the sides of the *President Roosevelt*, making a 100-foot circle of daylight brightness about the ship.

On the third day, after two of the *Roosevelt's* men had been swept away in a futile attempt to launch a lifeboat, the men on deck renewed their efforts to shoot a line across. Ten more shots were fired—and every one of them

(Continued on page 114)

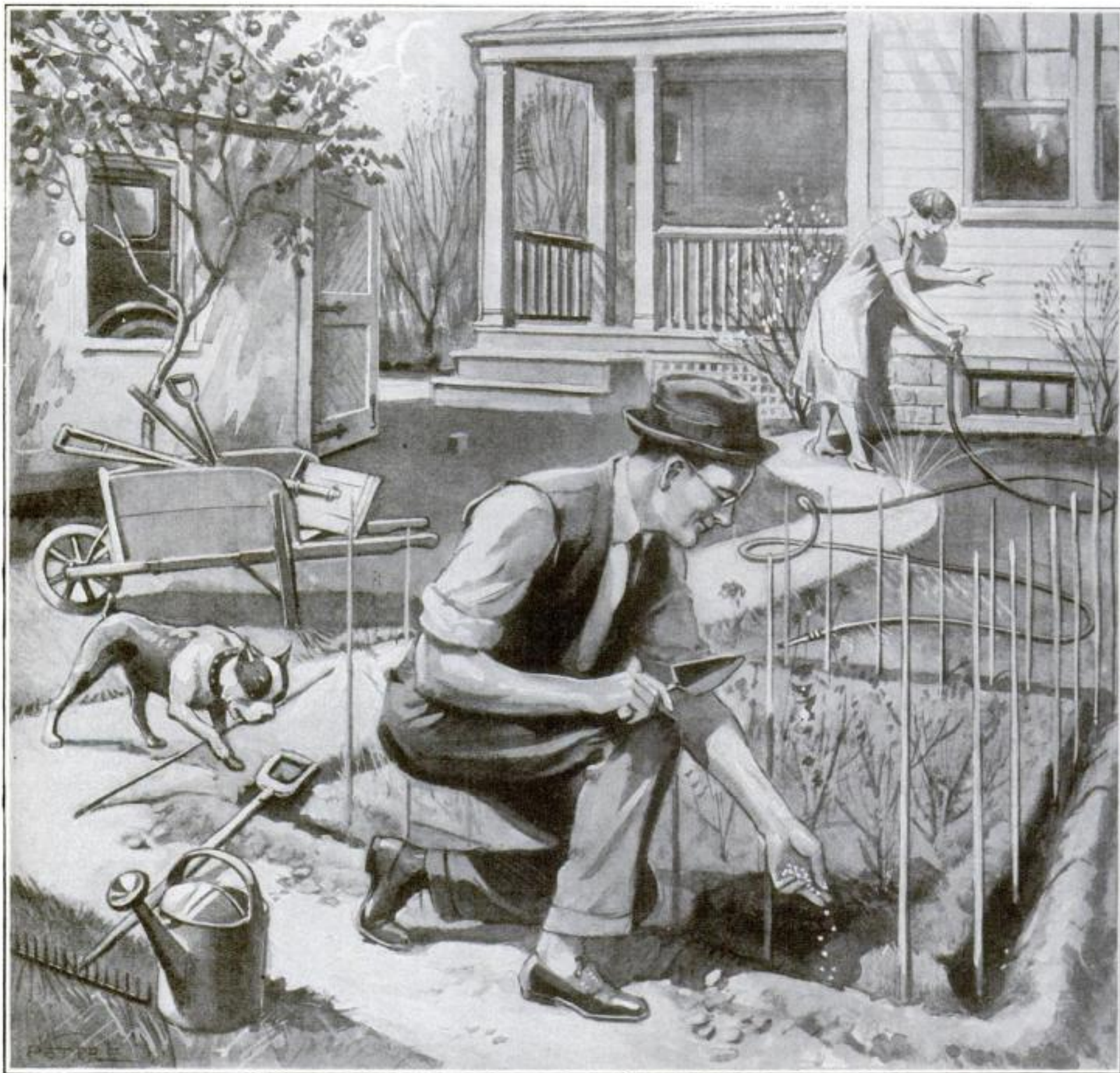
New Life-Saving Method

Drawing shows kite and breeches buoy combination recently proposed by Dr. Miller Reese Hutchison of the Naval Consulting Board for taking people off disabled ships



What's Wrong in *This* Picture?

\$1,000 CASH PRIZES



JOHN and Mary Newlywed have decided it is time to get their garden started. So, taking advantage of the fine weather, they have begun enthusiastically, if not skilfully, to prepare the ground.

Are they going about it right, or are they bungling the job? If they are making mistakes, what are they? The artist, too, deliberately made a few errors in drawing the picture. Find them, also

ARE YOU quick at observing things around you? Are you always on the alert to see that everything is done right? Here is an opportunity to prove that you really are, and in so doing to win one of the cash prizes. POPULAR SCIENCE MONTHLY is offering in its fascinating series of Picture Contests.

The contests began in the March number, but you can start now. Each contest is a separate competition and complete in itself. It is not necessary for anyone to

have entered the preceding competition.

The idea is this: In each issue you will find a picture in which John and Mary Newlywed are the principal characters in a little home comedy. John and Mary are inexperienced, but that does not deter them from undertaking odd jobs around the house. Naturally, like everyone else, they have to learn by mistakes. And they make many. In addition, for good measure, the artist draws a number of things in each picture incorrectly. Your task is

to find all mistakes made either by the Newlyweds or by the artist.

Cash prizes amounting to \$1,000 will be awarded to those who point out the greatest number of errors in this month's picture and who also give their reasons in the clearest and cleverest way. The prizes are sixty-three in number, so you have that many chances of winning.

The contest is open to everyone, and you can submit as many sets of answers as you wish. If you already have won a

prize in one of POPULAR SCIENCE MONTHLY's preceding contests, you still may compete in the present one. Prizes for each month's contest will be announced in every case as soon as possible.

Before you begin to study the picture this month, be sure to read the rules of the contest carefully. Then examine the picture closely, going over every detail thoughtfully. As you come upon an error, make a note of it. Ask members of your family, friends, and neighbors to tell you what they consider wrong in it. If you think you lack knowledge on one or more points, consult someone who is experienced.

When at length you can find no more mistakes, make out a list of all you have found and give your reasons for calling them wrong. Remember to number your answers. Use pen and ink or typewriter, and write on only one side of the paper. Address your entry to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. All answers for this month's contest must be mailed not later than May 30.

If you wish to submit additional an-

Here Is the List of Prizes Will You Win One?

POPULAR SCIENCE MONTHLY is awarding \$1,000 in sixty-three cash prizes for the best answers submitted in this remarkable Picture Contest. The cash prizes will be distributed as follows:

First Prize.....	\$ 500
Second Prize.....	100
Third Prize.....	50
10 Prizes, \$10 each.....	100
50 Prizes, \$5 each.....	250
Total Prizes.....	\$1,000

swers, you may do so, but send them in as complete separate entries. Where more than one set of answers is entered, the judges will consider each set as a separate entry complete in itself.

The three judges who decide on the winners are Professor Collins P. Bliss,

director of the Popular Science Institute of Standards and head of the department of mechanical engineering, New York University; Dr. Hazen G. Tyler, associate director of the Popular Science Institute of Standards and associate professor in experimental engineering, New York University; and Alexander Senauke, M.E., E.E., radio engineer of the Popular Science Institute of Standards. Their decisions will be final in all cases.

The first two Picture Contests in our new series have evoked great enthusiasm among our readers, judging by the expressions we have received from thousands of them. We were practically deluged with the flood of contributions for the first contest. And already we have had a legion of entries for the April contest.

In next month's issue, another picture will appear, fully as curiosity-provoking as this month's. If you failed before, don't be discouraged. You may score heavily in this one. But whatever your success, you will gain a fund of practical knowledge from John and Mary Newlywed's mistakes that will repay you.

The Rules of the Contest—Follow Them Carefully

1. Each month, until further notice, POPULAR SCIENCE MONTHLY is printing a picture of John and Mary Newlywed doing some simple job about the home. Each picture shows John or Mary, or both, doing one or more things in the wrong way. In addition, there are a number of deliberate mistakes by the artist in drawing the picture. You are to tell us what things are being done wrong and what things are drawn wrong in each picture, and why they are wrong.

2. POPULAR SCIENCE MONTHLY will award \$1,000 each month in sixty-three cash prizes for the best answers giving the greatest number of mistakes in the picture. These prizes will be distributed as follows:
First Prize..... \$500
Second Prize..... 100
Third Prize..... 50
Next 10 Prizes, \$10 each..... 100
Next 50 Prizes, \$5 each..... 250
Total Cash Prizes.....
each month..... \$1,000

3. Prizes will be awarded to those persons who point out the largest number of actual mistakes found in the picture and who present their explanations of the errors in the clearest and most skilful way. Actual mistakes shall be construed in all cases to mean mistakes appearing in the picture about which there can be no question in the opinion of the judges. In case of ties, the full amount of the prize will be given to each tying contestant.

4. Answers to each picture must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the picture appears. Thus, to insure consideration in this month's contest, answers to the picture in this month's issue, published April 10, must be mailed or delivered

changes or corrections will be allowed in any entry after submission, but any contestant may submit as many separate entries as he desires.

6. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

7. You pay nothing. Just prove your knowledge and observation. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at public libraries free of charge. Each contest is open to everybody, except

employees of POPULAR SCIENCE MONTHLY and the Popular Science Institute of Standards and their families.

8. Officials of the Popular Science Institute of Standards will act as judges and their decisions will be final. Acceptance of these rules is an implied condition of each entry.

Another Contest in June

THE fourth \$1,000 Picture Contest of this fascinating series will appear in next month's issue. Watch for it. Other similar contests will appear in succeeding issues of POPULAR SCIENCE MONTHLY. Each will be a complete contest in itself. So, if you should fail to win a prize in one month's contest, you still have as good a chance as any one else to win one the next month.

not later than May 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

5. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink, and on one side of the paper only. Each error must be listed separately and numbered. No

The Typical American Emerges at Last



The American type, Dr. Hrdlicka finds, is the tallest of all larger groups of white people. In physical and mental fitness he has not suffered by the flood of immigration

Many Bloods Fused into Distinct New Kind of Man—Tall, Slender, Energetic

crowded with peoples of every nation and a certain type of man came along, you would say involuntarily, "That's an American." Certain things in the way he looked and acted would cause you to recognize him.

According to Dr. Hrdlicka, one of these characteristics is height. The typical American is the tallest of all groups of white people. In the wide spaces of a new country, he has had room to grow. His average height is about five feet, nine inches.

The typical American is naturally slender. In comfortable middle age he may develop an "automobile paunch," but when a youth he is lithe and sinewy. His legs are long, and they move gracefully. He weighs on the average about 150 pounds.

Hair—usually brown and straight. Blond or curly-haired Americans stand out in a crowd because of their rarity.

A mixture of many bloods shows in his eyes. They are light in color, either a hazel, or, if blue, mixed with brown.

The head of the typical American is perceptibly larger than those of other nationalities. Facial characteristics differ according to occupation. Some whose ancestors were farmers or laborers, have jaw and cheek bones that are inclined to protrude, with skin drawn taut over them. Abraham Lincoln is a pronounced example of this type. Those with white collar jobs have more rounded features, with bones less prominent.

The typical American face is frank, healthy, intelligent, with medium high

forehead, rather long nose, ears long and broad, and mouth moderate in width. His arms, hands, and feet are relatively somewhat shorter than those of other nationalities. The chest is about equal in breadth but not quite so deep as in European immigrants.

The character of the American is as pronounced as his appearance.

"The main characteristics of the American type," Dr. Hrdlicka explains, "are, in general, frankness, openness, yet shrewdness, energy and persistence, with little sentimentality or affectation as a general rule, and with relatively few extremes in action."

MOTION-PICTURE directors, following intuition rather than the measurements of anthropologists, have hit upon virtually the same type to represent America. The hero who usually is picked to represent the good old U. S. A. is exactly the tall, energetic, determined-looking fellow that Dr. Hrdlicka describes.

In arriving at his conclusions, Dr. Hrdlicka examined more than 1,500 adults, both men and women. These were descendants of what he calls "Old Americans," that is, the early stock of America.

Many Americans have feared lest the strain of American blood has deteriorated through the influx of immigrants. The Washington investigator says that his studies prove the contrary. Even children of immigrants who were undersized or under the standard of mental and physical fitness have developed amid wholesome American surroundings into sturdy, quick-on-the-mark individuals.

THERE is such a thing as a typical American. Dr. Ales Hrdlicka, noted anthropologist of the Smithsonian Institution, Washington, says he has found him.

Almost since the Pilgrims landed, we have been in doubt on the subject. We could reach down in the melting pot that is the United States and draw out almost any type—a broad-shouldered Briton, an olive-skinned Italian, a round-faced Armenian, all Americans by birth and breeding. To say which best represented America was a puzzle.

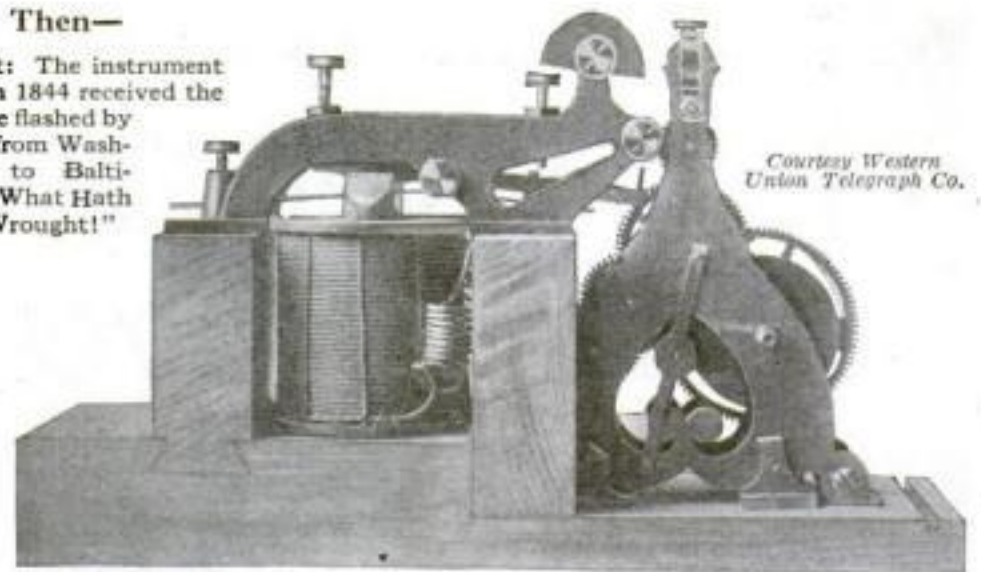
But now after fourteen years of careful measurements and examinations, a scientist says that, although our history is short, there has been time for all the different types to fuse. Out of them all, he finds, is emerging a new type of man, distinct from those of all other lands. Within 200 years, he believes, this type will be clearly developed into a characteristic American race distinguished by its virility and energy.

Even now, if you were on a street



Then—

At right: The instrument which in 1844 received the message flashed by Morse from Washington to Baltimore: "What Hath God Wrought!"



Courtesy Western Union Telegraph Co.

—and Now

At left: The remarkable automatic typewriter-receiver used today in the 7400-mile circuit between London and San Francisco. On a ribbon of paper the machine prints the message in instantaneous response to an operator a distance of thousands of miles away

his idea. His mind was on fire. He had little if any technical knowledge of electricity; yet he had been keenly interested in its mysteries ever since the day when, as a young student, he had clasped hands in a circle with other students at Yale College and had felt the tingle of an electric shock pass through his body. In a general way he was familiar with the operation of the battery, the electromagnet, and other important discoveries in electrical science.

NOW he took these separate discoveries as he found them and worked them over in his mind into a practical system of sign writing at a distance. Instead of an electric spark to produce his dots and dashes at the receiving end of the wire, he would use an electromagnet to move a metal lever up and down as the electric circuit was made and broken. In his scratch book he drew little sketches of the instruments and wires he would use. These he showed to his fellow passengers, who raised their brows skeptically as he tried to explain his ideas to them.

At last the *Sully* arrived in port, and Morse went to the skipper, Captain Pell, to say farewell.

"Well, Captain," he said, "if you should hear of the telegraph one of these days as the wonder of the world, remember the discovery was made on board the good ship *Sully*."

Those prophetic words marked Morse's achievement as one of the most extraordinary feats in all the history of invention. Seldom, if ever, has an inventor so completely grasped the full significance of an idea at the moment that idea was born in his mind, or so completely foretold its successful fulfillment.

Yet in his supreme confidence that he had brought forth a new wonder of the

world, Morse little dreamed of the years of struggle, poverty and bitter discouragement he must pass before his invention could be put into practical service. Where other inventors have sacrificed all in the struggle to bring an idea to perfection, Morse's great battle was to "sell" his virtually completed idea to an unbelieving and scoffing public. To this purpose he sacrificed fame and position, already gained in another field, and devoted a dozen years of heart-breaking labor.

The extraordinary thing about Morse is that he was a man who lived two distinct lives, and who climbed from the bottom to success in each of them. In his life as an artist, he began as a strolling "peddler," barely keeping clothes on his back and food in his stomach by painting portraits of New England country folk as he wandered from village to village. In less than a score of years, by dogged persistence, he became the foremost

portrait painter in America, before whom sat presidents and generals and statesmen, and whose works, as head of the National Academy of Design, were acclaimed at home and abroad.

Then, just at the moment when he reached the height of fame as an artist, just when he was returning from triumphs in Europe, with bright prospects for financial ease and still higher honors, an inspiration from the clouds caused him to renounce all he had gained and begin again—this time as an inventor with a great idea.

IN THIS second life of his, however, he called to his aid a wealth of valuable experience from the first. As a struggling artist, he had mastered the lesson of everlasting persistence. He had learned that perfection comes only after countless trials and failures.

Once, for example, while he was a young art student in London, he carefully finished a drawing which he intended to offer to the National Academy for admission. He showed it then to one of the great English masters of the day, Benjamin West.

"What do you think of it?" asked young Morse, hopefully.

The master artist examined the drawing closely for some moments.

"Very well, sir, very well," he said finally. "Go on and finish it."

"But it *is* finished," said Morse in surprise.

"Oh, no," West answered. "Look here, and here," pointing to a number of unfinished places that had escaped Morse's untrained eyes.

Somewhat disappointed, the young artist took the drawing back to his lodgings, where he labored over it for a week. Then he returned. This time the master was lavish with his praise.

"Very well indeed, sir," he said. "Go on and finish it."

"But isn't it finished?"

"Not yet. See, you have not marked that muscle, nor the articulation of the finger joints."

Again Morse spent days retouching his picture.

"Very clever, indeed," said West when he came the third time. "Well, go finish it."

"I can't finish it!" cried Morse. (Continued on page 135)

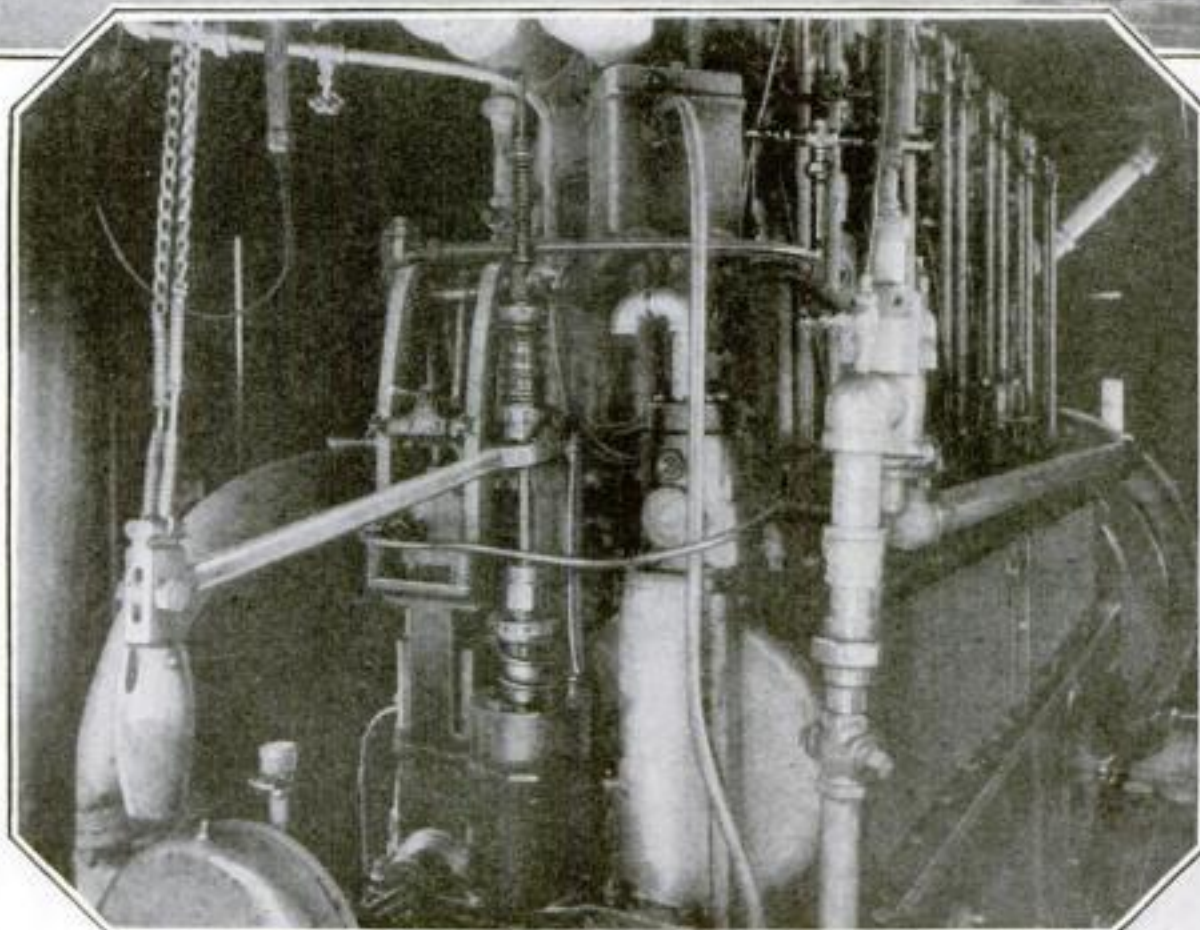
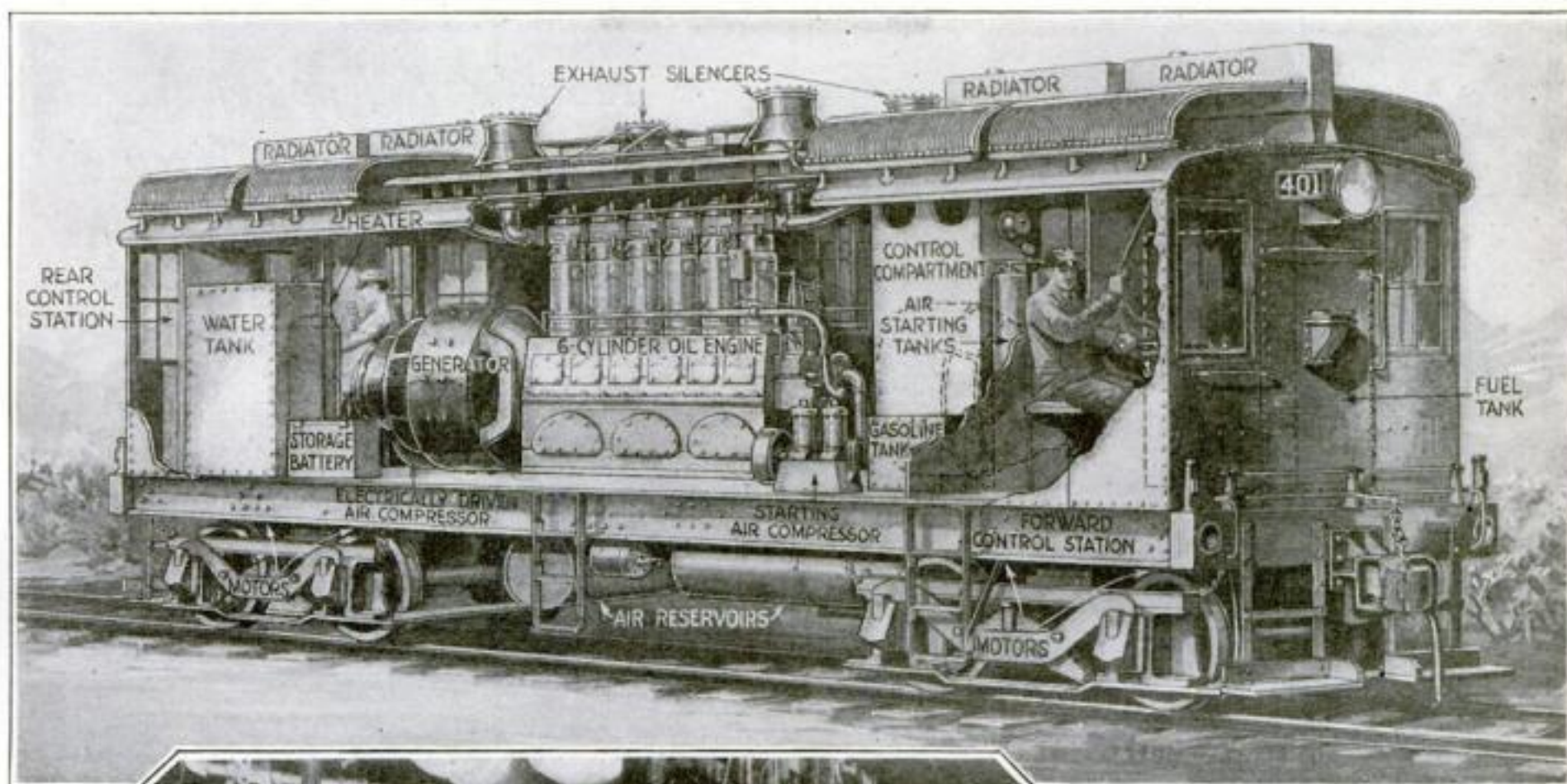
From Our First Issue

FFIFTY-FOUR years ago, shortly after the death of Morse at the age of 81, the first issue of POPULAR SCIENCE MONTHLY, appearing in May, 1872, paid this prophetic tribute:

"Professor Morse has completed his career, and taken his place in the past. He belongs now to memory and to fame, and his name and work will help to save our age from oblivion.

"After a few thousand years, when the inferior races of men shall have disappeared from the earth, except perhaps a few samples preserved as antiquarian specimens; when civilization has overspread the world, and the telegraph system has become so universal and perfected that any individual will be able to put himself into instantaneous communication with any other individual upon the globe,—then will the name of Morse, one of the great founders of the system, be more eminent than any upon whom we now look back as the illustrious of ancient times."

Now Come Oil-Electric Locomotives

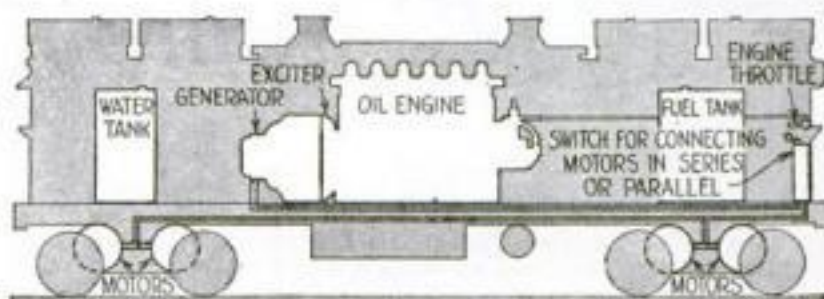


The Engine of the Future

The drawing above shows the construction of the powerful new oil-electric locomotive which, according to its inventors, may supersede steam and electric engines on American railroads. Note the compact arrangement of its various features.

Capable of Vast Power

At the left is a front view of the giant six-cylinder, sixty-ton engine that furnishes the power for the latest type of locomotive which, it is claimed, will one day haul a train across the continent without a stop.



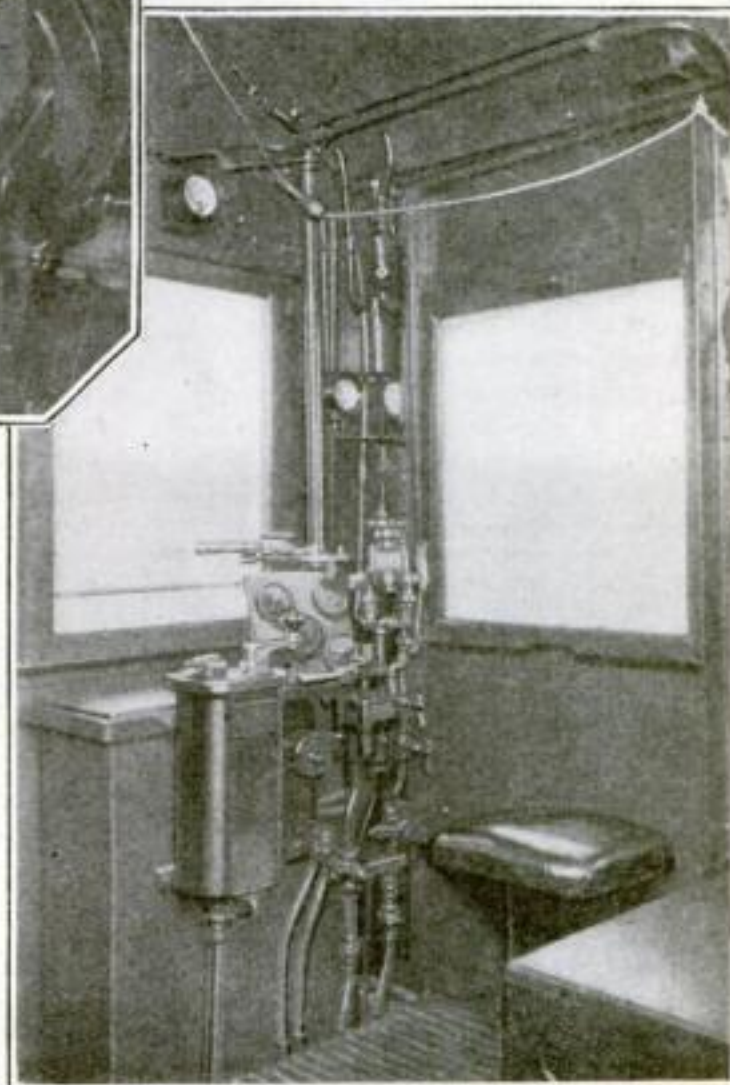
How Controls Work

The plan at the left illustrates how the oil engine, the generator, and the motors on the front and the rear wheels are connected with their controls in the engineer's station.

THE introduction of oil-electric locomotives marks the latest advance in railroad operation in this country. These new locomotives, perfected within the last few years, are said to be as speedy as the fastest steam engines, and to have tremendous hauling power.

They are able, it is claimed, to haul a train across the continent without a stop for changing engines or for fuel or water. Cinderless, smokeless, and noiseless, they insure cleaner and more comfortable passenger trains. Superior power and more economical operation than steam locomotives are reported as the result of recent tests by the Central Railroad of New Jersey, in which a sixty-ton oil-electric engine handled, in a given period, 11,000 more tons at a fuel cost of twenty percent less than a steam engine.

The use of these engines, it is said, will reduce maintenance costs one half, and each engine will last twice as long as a steam locomotive.



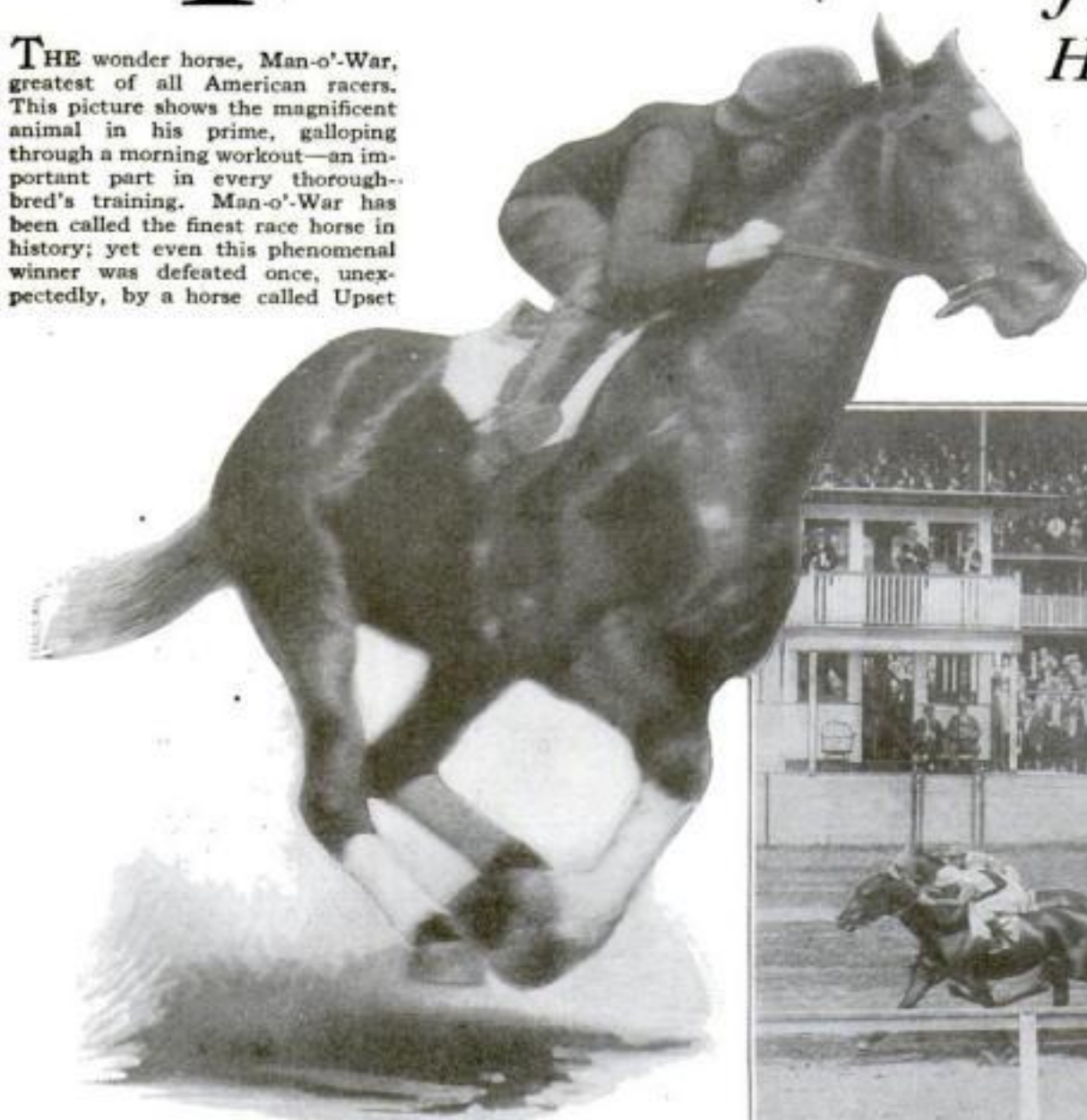
Simple and Compact Control

The control station of an oil-electric locomotive. The engine throttle is seen in front of the window, with the motor control just below for convenient operating.

It's a Game of Glorious

*How the Science of Making
Race Horses Often Is
Upset in the Stern
Test of the Track*

THE wonder horse, Man-o'-War, greatest of all American racers. This picture shows the magnificent animal in his prime, galloping through a morning workout—an important part in every thoroughbred's training. Man-o'-War has been called the finest race horse in history; yet even this phenomenal winner was defeated once, unexpectedly, by a horse called Upset



A Tense Moment

A typical scene during one of the thousands of horse races which each year attract multitudes of screaming, hysterical spectators

LITHE thoroughbreds, coats gleaming with sweat, clods of earth and swirls of dust rising beneath their thundering hoofs; straining, panting, yet moving with rhythmic grace as their space-devouring leaps carry them down the yellowish ribbon of track.

Stunted, hard-faced jockeys in blouses and caps of brilliant silks, hunched like monkeys on sticks on the very necks of their mounts, their spare bodies bobbing violently up and down as they urge the horses to greater speed.

Roars and screams from the throats of hysterical thousands growing in swift crescendo to a deafening blast as the field sweeps by the neat pagoda that shelters the judges and marks the finish of the race.

Then, suddenly—silence.

For a moment you hear the gentle flapping of flags on the grand stand roof. Then comes a hum of conversation, and the rustle of paper—programs, newspapers, "dope sheets"—as the onlookers discuss the event just run. The horses, brought to a stop a quarter of a mile or so beyond the finish line, turn and trot leisurely back to the judges' stand, where the jockeys salute, dismount, "weigh in," and pass back to their quarters. Hostlers throw light blankets about the horses and lead them to the barns. A band blares forth in a lively tune.

That's horse racing, famous "sport of kings," the most romantic and glamorous game of all—as you see it from the grand stand. Twelve thousand times a year,

approximately, such scenes are enacted on recognized tracks in the United States, Canada, Mexico and Cuba alone.

But from the grand stand you see only one side of racing—the spectacular side. Behind, is an earnest, studious group of men—breeders, trainers and owners—to whom horse racing is a science; a field for constant research and experiment. With them, racing goes far beyond the bustle and excitement of a race meeting to quiet farms where animals are bred scientifically and trained systematically.

THE study of eugenics and heredity is an everyday part of their business, and some of them can trace the ancestry of their charges back beyond Bully Rock, the first thoroughbred to come to America, and other famous horses, imported into Virginia from England long before American independence. With justifiable pride, they will tell you of the proud lines of British and Colonial ancestors from which this or that horse is descended.

With these men, the cardinal principle of the science of horse breeding is stated readily. Mares which have been winners and come from lines of winning horses are



Nine Days Old—a Future Winner?

This ungainly little new-born filly comes from a line of winners—from Mercia (above) by Purchase, a famous racer. Whether the baby will be a winner, too, is one of the uncertainties of the game; but in any event she will be coddled, petted and trained as all racers are

mated to horses that likewise come from winning lines. The theory is that the progeny should be winners also. But sometimes—very frequently, in fact, horse racing being the uncertain proposition that it is—they are not.

The foals, coming in March or April, make their bow as yearlings to the public in the sales ring early in their second summer. Colts and fillies of distinguished ancestry bring high prices at these

Uncertainties

By GEORGE LEE DOWD, JR.

auctions, the purchasers being guided largely by heredity. Sometimes these colts justify their heritage; more frequently, though, they do not. Thus, of about 200 well-bred yearlings sold to leading American racing stables in 1924, only about seventy proved themselves "bargains" in their first year of racing last season. Of the rest a goodly number won not a single purse for their purchasers.

OF COURSE, these young horses may prove worthy descendants of their noted ancestors in later years of racing, or in time may themselves beget real racers, who will repay their breeders a thousand fold for their investments.

But it is a rash man who will dare hazard a prediction as to what a race horse will or will not do. And it is in this constant, glorious uncertainty that lies the real explanation of the lure of racing. There is an old saying among turfmen that "anything can happen at a race track." And "anything"—that is, the unexpected—does happen—and every day!

With flying leaps, graceful in every movement, the racer thunders down the yellow track



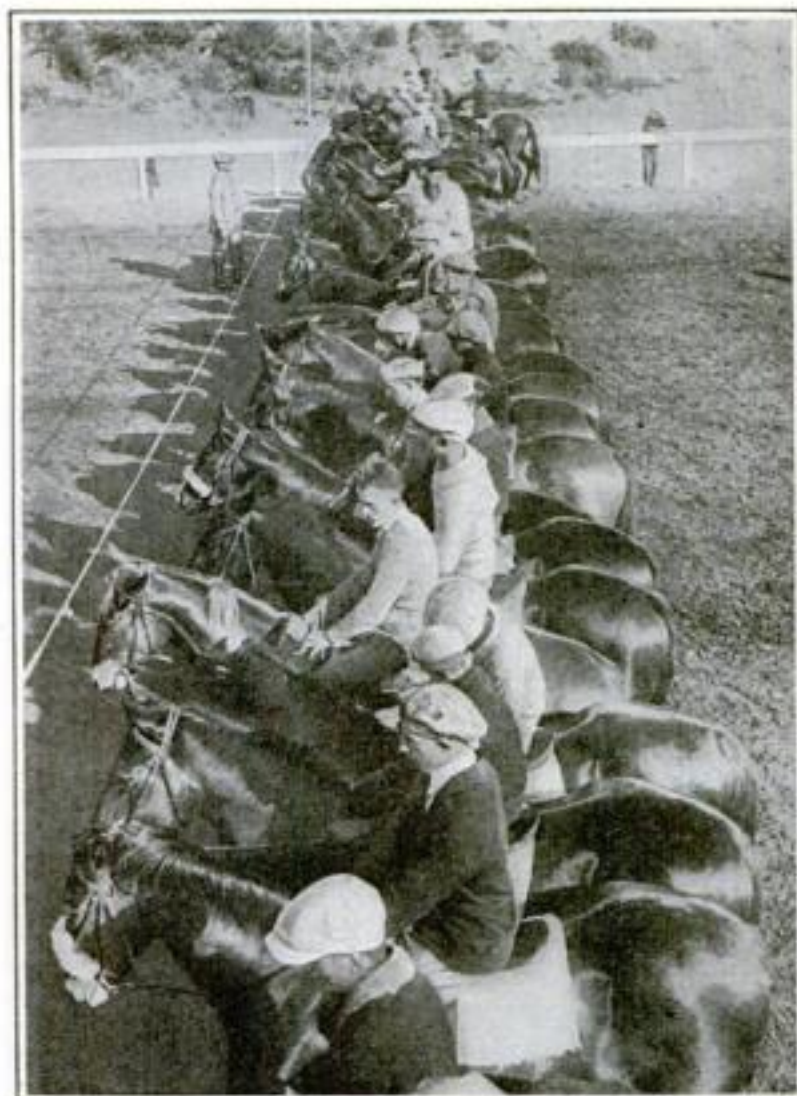
A few months ago one of the best American trainers prepared a list of one hundred ways in which the best horse could be beaten in a race. These ranged from falling to being nosed out at the finish because an excited jockey turned his head as his hat blew off.

In 1923 a Chicago turfman, William Daniel, picked up a yearling colt, Master Charlie, at auction for \$1,000. In the following year's racing the colt won stakes and purses aggregating \$95,525, and was acclaimed by some the best horse of any age in the country. But, before the first spring stakes were run last year, Master Charlie developed unsound legs and was withdrawn from racing.

Two years ago Mrs. Payne Whitney paid \$15,500 for a yearling colt, Nurmi, half-brother of the illustrious Zev, hero of the famous \$100,000 international race with Papyrus, English Derby winner. Last year Nurmi won only \$2,478, scarcely a fair return on his purchase price. In January of this year, though, he justified his owner's and

"Schooling" at the Barrier

A remarkable photograph showing how young horses are schooled by the official starter to stand quietly behind the barrier while it is down. The instant the barrier is "sprung," they leap forward. Seldom can the restless young animals be made to keep as straight and quiet a line as this



trainer's faith by scoring a wholly unlooked-for victory in a \$30,000 stake race.

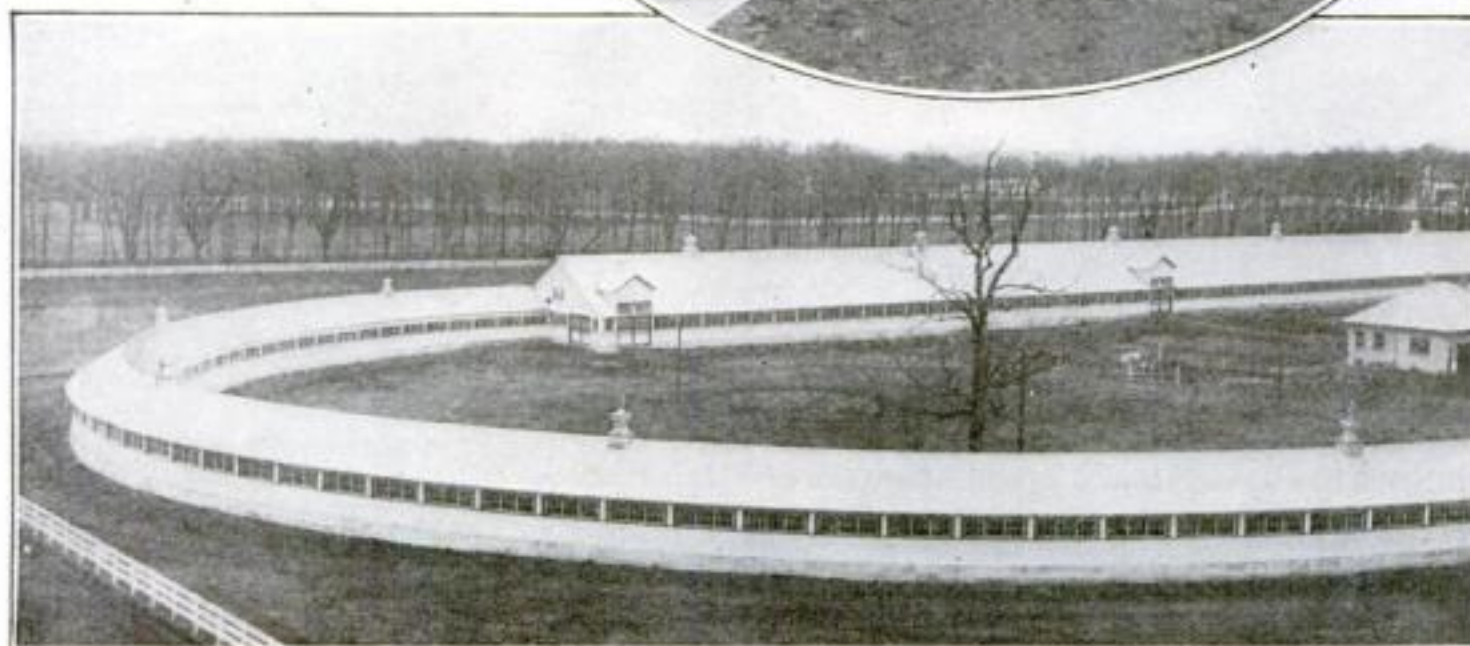
One might go on recounting similar cases almost without end. There was, for example, the colt, Playfellow, full brother of the great Man-o'-War. Harry S. Sinclair, the oil magnate, paid \$100,000 for this animal, in the hope that he would follow the family habit of making turf history, only to discover that Playfellow's constitution and habits precluded the possibility of his ever becoming a high class horse. Before that Samuel C. Hildreth, trainer of Sinclair's Rancocas stable, paid \$115,000 for the colt Inchcape, son of Friar Rock, three-year-old champion of ten seasons ago, only to have Inchcape develop a skin disease that made him unfit for racing.

Yet, although this uncertainty of race horses

(Continued on page 130)

The Training Camp

Every large race track has an inclosed course where the horses are kept in training during the winter. These views of the Rancocas farm in New Jersey show how the track and stables are housed under one roof. Notice, in the oval picture, how these novel palatial stalls line the track



How Large Can a Star Be?

New Discoveries Show That a Sun More Than Fifty Times the Mass of Ours Would Burst into Fragments

By NEWTON BURKE

TO MOST of us, the Sun, which for millions of years has been lighting and warming the Earth day after day, seems quite the greatest and most important body in the universe. Yet actually our Sun is a relatively unimportant little pinhead of fire compared with some of the vast flaming stars swinging through space so far distant from us that they can scarcely be detected with the powerful instruments of astronomy.

Just by way of comparison, imagine that you could hop into your car some day and travel without stop indefinitely. At a continuous speed of sixty miles an hour, you could complete a trip around the Earth's equator in about seventeen days and eight hours. In a little less than five years, you could cover the distance at the same speed around the Sun. But to circle Antares, the largest star we know of, in your fastest motor car, you would take approximately 1,370 years!

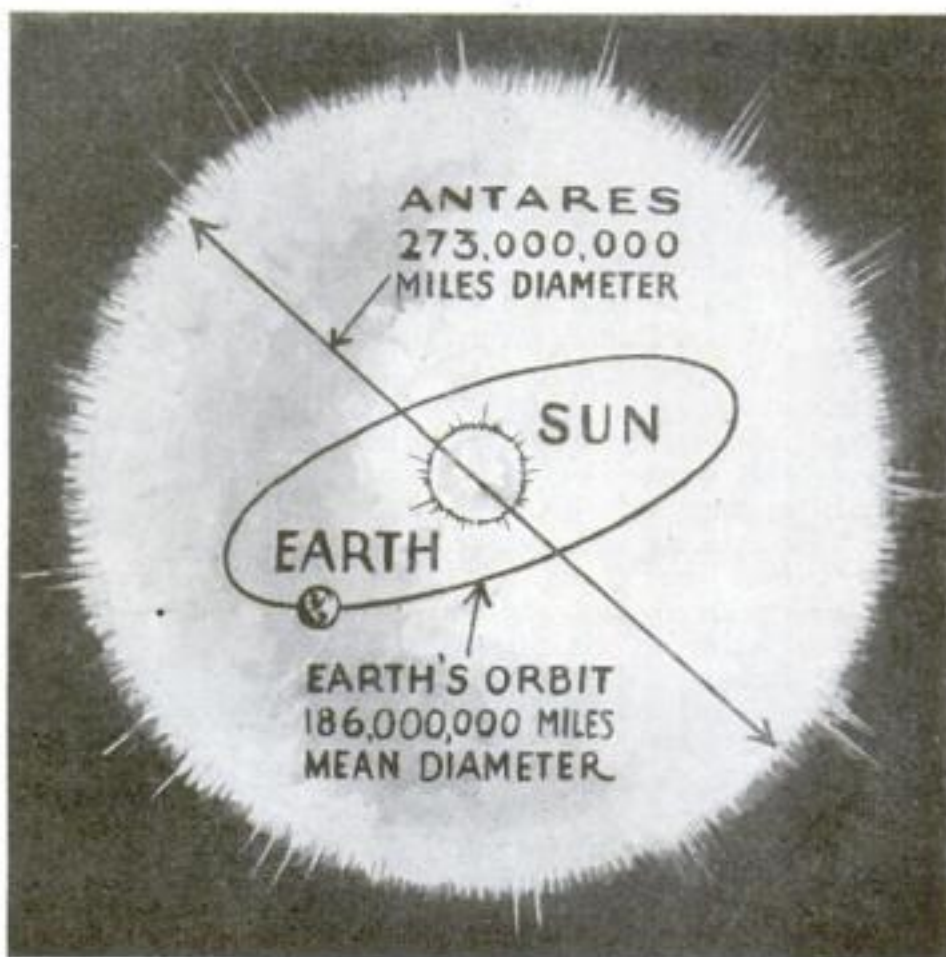
The diameter of Antares is estimated at more than 273,000,000 miles, or more than 300 times that of the Sun. And Antares is only one of a number of giant stars. Betelgeuse and *alpha* Hercules are almost as large. They are so huge that not one of them could find room in the vast circle described by the Earth in its path around the Sun.

BALLS of fire so enormous as these stagger human imagination. Quite naturally, they lead us to ask whether there is any limit to the size of a star; and, if so, how large it is possible for a star to be.

Answers to these questions recently have been given through remarkable measurements by A. S. Eddington, noted British scientist.

A star whose mass is fifty times that of our Sun, this astronomer found, has reached its limit in greatness. Stars of greater mass than this cannot exist; they would burst of their very enormity. Their own pressure from within, combined with the centrifugal force of rotation, would overbalance the force of gravitation holding them together, and they would fly apart in billions of fragments!

In these calculations it must be remembered, of course, that the mass of a star depends on the weight of materials composing it, and is quite a different thing from volume. Thus, while the great star Antares is hundreds of times



Greater Than Earth's Whole Path around the Sun

Antares, the largest known star, is just one of a number of giant stars, none of which could find room in the vast circle described by our Earth in its path around the Sun. To motor around it would take 1,370 years.

larger in dimensions than the Sun, its mass is within the outside limit of fifty times the mass of the Sun.

Eddington's startling conclusions were reached through a study of the light radiation of stars and its causes, by means of ingenious modern instruments of measurement, such as Michelson's interferometer, the spectroscope, and improved photographic apparatus. He learned that in the center of a star whose mass is one



Equal to 6,000 Big Guns

The terrific pressure at the center of the Sun has been estimated at about 180,000,000 pounds to the square inch—6,000 times the breech pressure developed in firing our largest coast defense gun. A star more than fifty times the total mass of our Sun would burst

and one half that of our Sun, the heat reaches the tremendous temperature of 8,550,000° F. Even a spot halfway between the center and the surface reaches 2,395,000°. The pressure at the center is 21,000,000 atmospheres, or more than 300,000,000 pounds to the square inch—at least 10,000 times as great as the breech pressure of Uncle Sam's largest coast defense gun.

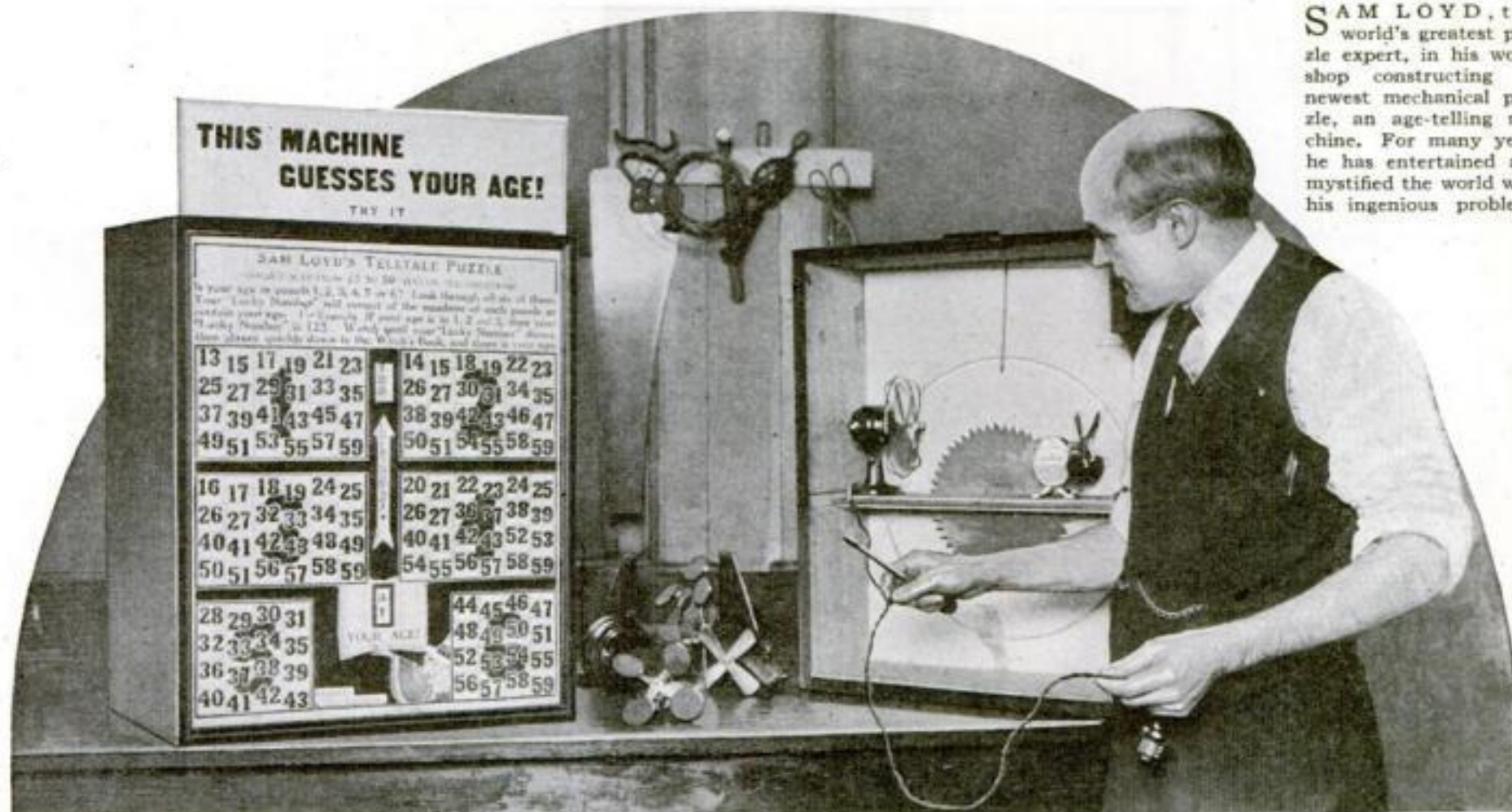
EDDINGTON learned, too, that just as there is a limit to the greatness of stars so also there is a limit to their smallness. A star less than one seventh the mass of our Sun, he discovered, would cease to shine. For the temperature at its surface could not reach 5400° F.—the lowest temperature at which a star can remain visible by light radiation.

Of dwarf stars, there are undoubtedly far more than we know of, but most of them are invisible to us even through the most powerful telescopes. The smallest observed and studied, a distant companion to *alpha* Centauri, is probably close to the limit of visibility and gives only $\frac{1}{800,000}$ part of the light of the Sun. These dwarfs have diameters between 155,000 and 580,000 miles in length, hence are much smaller than the Sun, which has a diameter of 865,350 miles.

THESE new measurements, incidentally, led to interesting conclusions about our Sun. For instance, his calculations indicate that the highest surface temperature the Sun ever reached was about 16,200° F., while its present surface temperature is not more than 10,800°—thus supporting the theory that our Sun is a "dying star."

That such may be the case, however, need cause us no alarm, scientists tell us; for even if the Sun's energy should continue to decrease at a regular rate, it would take millions of years before it would cool off enough to injure life on Earth. In fact, astronomers say the Sun does not get its heat by burning up as we burn coal. Instead, much of its heat seems to be developed by explosions or changes in atoms of matter composing it.

Thus, so far as we are concerned, its store of energy is inexhaustible. The Sun has been supplying warmth to its family of planets for probably millions of years and, to the best of our knowledge, will continue to do so for many centuries to come.



SAM LOYD, the world's greatest puzzle expert, in his workshop constructing his newest mechanical puzzle, an age-telling machine. For many years he has entertained and mystified the world with his ingenious problems.

Can You Solve the World's Greatest Puzzles?

Millions Have Tried—Sam Loyd, Famous Inventor of Brain Twisters, Reveals Some of His Secrets

By SAM LOYD

I HAVE never met a normal, thinking person whose bump of inquisitiveness did not lead him to take at least a mild interest in puzzles. When a man tells me he is utterly indifferent to puzzles and never tried to solve one, I can only conclude that he is lacking in a certain wholesome enthusiasm, without which life is a drab affair.

For while jostling against all manner of people it has been impressed on my mind that the successful ones are those who have a natural faculty for solving puzzles. Life is full of puzzles, and we are called upon to solve such as fate throws our way. We are constantly propounding and solving puzzles without realizing it. Exactly the same faculties that business problems engage are brought into action in puzzle solving.

To set aside a certain type of mind as of the puzzle solving kind would be a rash assumption. Puzzlers are recruited from all walks of life, and no particular profession, trade or occupation provides a larger quota than another.

Some of the world's great figures in science and letters have not been too proud to affix their names in authorship to puzzles. Famous scientists like Newton, Euler, Tyndall, Cardan, Huxley and Herschel, and eminent writers such as Byron, Voltaire, Ma-

The puzzles of Sam Loyd are known throughout the English-speaking world and for more than thirty years have appeared daily in a hundred American newspapers. His is a fascinating and unusual story.

caulay, Longfellow, Cowper, and Poe contributed brilliantly to the puzzle library.

Lewis Carroll, author of *Alice in Wonderland*, was an Oxford professor of mathematics and the author of many quaint and difficult puzzles.

P. T. Barnum was an inveterate puzzler, and exhibited his faith in the lure of

puzzles by using them in his circus advertising.

Thomas A. Edison has indorsed puzzle solving as a mental training, and reveals his own knack for puzzle construction in his famous questionnaires.

Theodore Roosevelt was a puzzle fan, and encouraged his children to participate in puzzle contests. During White House days the young Roosevelts were regular entrants in my puzzle solving tournaments, and more than occasionally flashes from the vigorous mind of the great American were discernible in the young folks' papers.

Hudson Maxim, the noted inventor, is as enthusiastic a puzzler as I know of. Once he wrote me, saying:

"Men and women are but children of a larger growth, and just as the kindergarten teaches the little folks by methods which make instruction interesting, so children of any larger growth are more effectively instructed by methods which awaken interest and pleasure by stimulating creative imagination through tasking it with the solution of an interesting problem. Puzzles are just the thing for teaching mathematics."

IN FACT, to print the roster of habitual puzzle solvers who are prominent in other circles would



The World-Famous
"14-15" Puzzle

This puzzle, originated more than fifty years ago, created a furore the world over. The problem is to move the blocks through the open space bringing the 14 and 15 into correct order as shown at the right. To work on the puzzle, cut a sheet of paper into squares and number them to correspond with the blocks. Then move them about on a larger square drawn on another sheet to correspond with the box

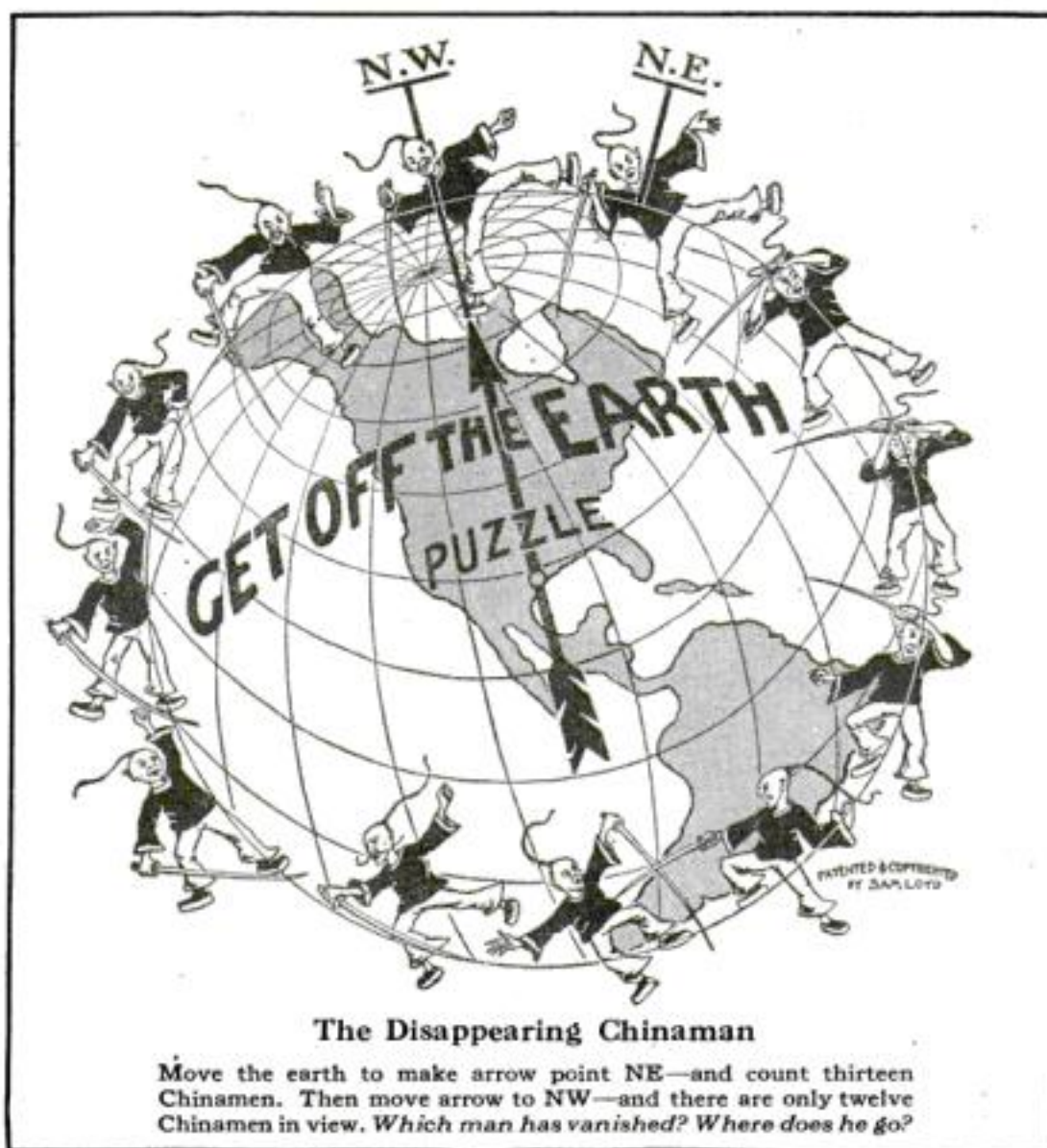
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

require a volume comparable to a city directory. The names of distinguished clergymen, lawyers, doctors, educators, authors and publicists are commonplace in the puzzle editor's correspondence. The devotion of these busy people to their puzzle practice is intense and constant. I have many correspondents who have been following my puzzles for years, and time seems only to intensify their devotion. A young lady of Boston, now in her eighties, has written me on the subject of puzzles at least once a month for the last twenty-five years.

THE art of puzzle composition consists of building a structure of ingenious clues around a skilfully concealed piece of information. The first object is to pique curiosity and imagination—in brief, to tease the solver into trying the puzzle. Without this lure, the puzzle is a failure. If it is difficult, that fact must not be apparent. On its face it must be like Bret Harte's Heathen Chinee—childlike and bland—although like that same individual it may be tricky and peculiar. The conditions must be clear and exact, permitting of no quibbles as to interpretation. It is a poor puzzle that relies upon twists in the meaning of words.

In the construction of these synthetic mysteries lies the sphere of the puzzle inventor, and for some reason the public is inclined to regard his operations as in the realm of black art.

Replying to the oft repeated query as to how puzzles are originated,—whether they come spontaneously or as a result of careful planning,—I would say that the best type of puzzle is usually a mixture of inspiration and science. Puzzles, like other inventions, are seldom made to order. They are, of course, developed and built up from ideas, but these nuclei must first be wooed and won.



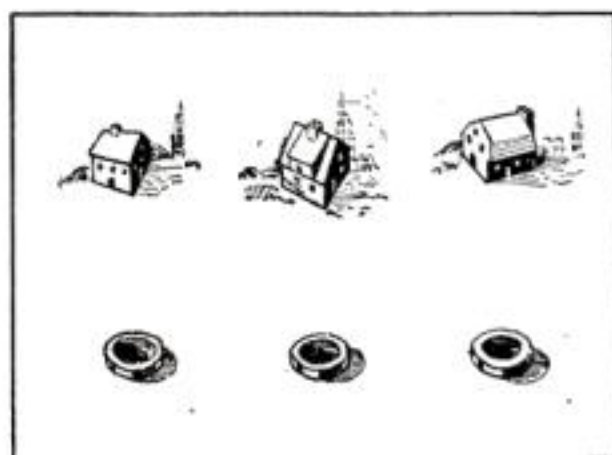
Thirty years ago, Sam Loyd invented this mystifying mechanical problem. Cut out the square, then cut carefully around the outline of the earth through the bodies of the Chinamen. Place the two pieces on cardboard and stick a pin through the earth's center so that you can revolve it. Then follow the simple directions printed on the puzzle above—and you will be surprised at the result.

Puzzles, of course, reflect the intellectual bent of their originators. The mathematician naturally evolves his problems from the science in which he is proficient, while the man with a literary bent will clothe his conceits in the peculiarities of

happy faculty for showing it off, can make the performer pass as a genius for a whole lifetime.

Like thousands of others, I can trace my initiation into puzzledom through the old 14-15 block puzzle, originated more than fifty years ago, and which was puzzling the entire nation when I was a lad. I stuck at that taunting box of blocks until I succeeded in proving that it could not be worked out! This statement, even at this late date, will be somewhat of a shock to many an old-timer who spent time that eventually had to be reckoned in years on this intriguing mystery.

Let us look again at this old box of blocks which drove your forbears nearly crazy half a century ago. As shown in the illustration on page 23, the fifteen blocks were arranged in (Continued on page 115)



This Is Sam Loyd's Best Puzzle

Each of the three householders was entitled to pipe water from each of the three wells, necessitating nine pipes in all, and they had to be laid according to the rule of the plumbers' union, which says that no pipe shall cross any other pipe. Can you show how each householder may have water piped from all three wells to either his front or rear door and without violation of the plumbers' aforesaid rule?

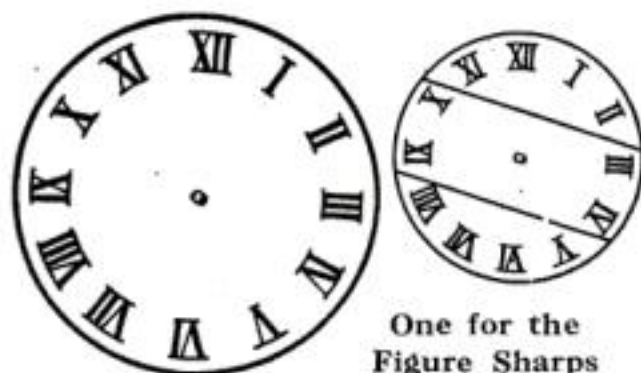
language. In the latter class are anagrams, acrostics, enigmas, charades, conundrums, riddles, rebuses, transpositions, and, of course, the puzzle family's healthy baby boy—the cross word puzzle.

Among these also should be mentioned palindromes—words or sentences that read backward as well as forward—a very ancient form indeed if it is true that Adam

introduced himself to Eve with the words, "Madam, I'm Adam." The most famous of palindromes is that purporting to be the great Napoleon's soliloquy, "Able was I ere I saw Elba." It is well authenticated that the "man of destiny" turned to puzzles for solace and recreation in the days of his exile, and a number of clever puzzles have been ascribed to him.

PUZZLES built upon geometrical principles are great favorites, especially those that deal with the dissection of plane figures. Most of the wooden and wire puzzles sold upon the streets and in shops are concerned with geometry.

Puzzles can be made out of almost anything in the hands of one whose talents lie in that direction. Young people take delight in puzzles which employ coins, buttons, match sticks, string, wire, pencils and similar common objects, and anyone with a good repertory of such wins their hearts. In fact, one clever trick as a stock in trade and a



One for the Figure Sharps

The smaller design shows how a clock dial may be divided into three sections, each of which contains numbers adding up to 26. Now all you are required to do is cut the larger dial into FOUR pieces so that the sum of the numbers in each of the four pieces will be the same. You'll find it a real puzzle.

6	1	8
7	5	3
2	9	4

Ancient Magic Square Puzzle

The diagram on the left shows the simplest form of Magic Square, a puzzle design whose origin is lost in the mist of antiquity. Each line of numbers—across, up and down, and the diagonals—adds up to 15. Can you reverse the proposition, rearranging the numbers in the diagram at the right, leaving the 5 in the center, and produce eight different totals when you add up the figures?

	5	

Unique Radio Pen Makes Ink Copies

Device Can Be Used on Your Set through Loudspeaker Jack



Metal Used for Contacts

The "radio pen" transmitter with the original drawing and print used for broadcasting. Metallic ink or zinc etching establishes the electrical contact

A REMARKABLE "radio pen," which traces in ink reproductions of cartoons, maps, printed matter or script broadcast from a distant station, has just been perfected by C. Francis Jenkins, inventor of the Jenkins process of transmitting photographs by radio. It is said to be the only existing device capable of tracing ink reproductions on a flat surface by radio.

The apparatus, surprisingly simple in appearance, is a small mahogany cabinet, about eighteen inches square and eight inches in height, and has a tilted top on which are mounted the "radio pen" and guides for holding and moving the paper beneath the ink stylus.

The pen is a metal arm about six inches long, having at one end a steel split pen point of the drafting type, and at the other end a small magnetic box, resembling the ear piece of a headset. This magnetic end is mounted on an axis, per-

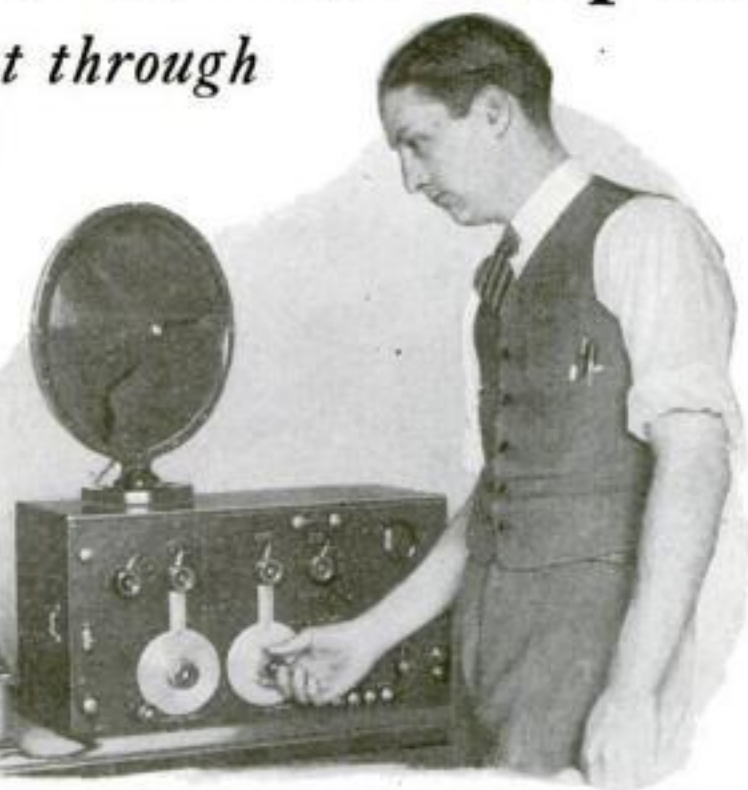


Traces Pictures in Ink

A close-up view of the receiving apparatus of the "radio pen" which reproduces all kinds of line drawings and print broadcast by transmitter

mitting the pen to sweep across the paper in arcs the width of the sheet.

The pen, which is hinged to the arm, is connected to the "ear piece" with a



Operates on Any Radio Set

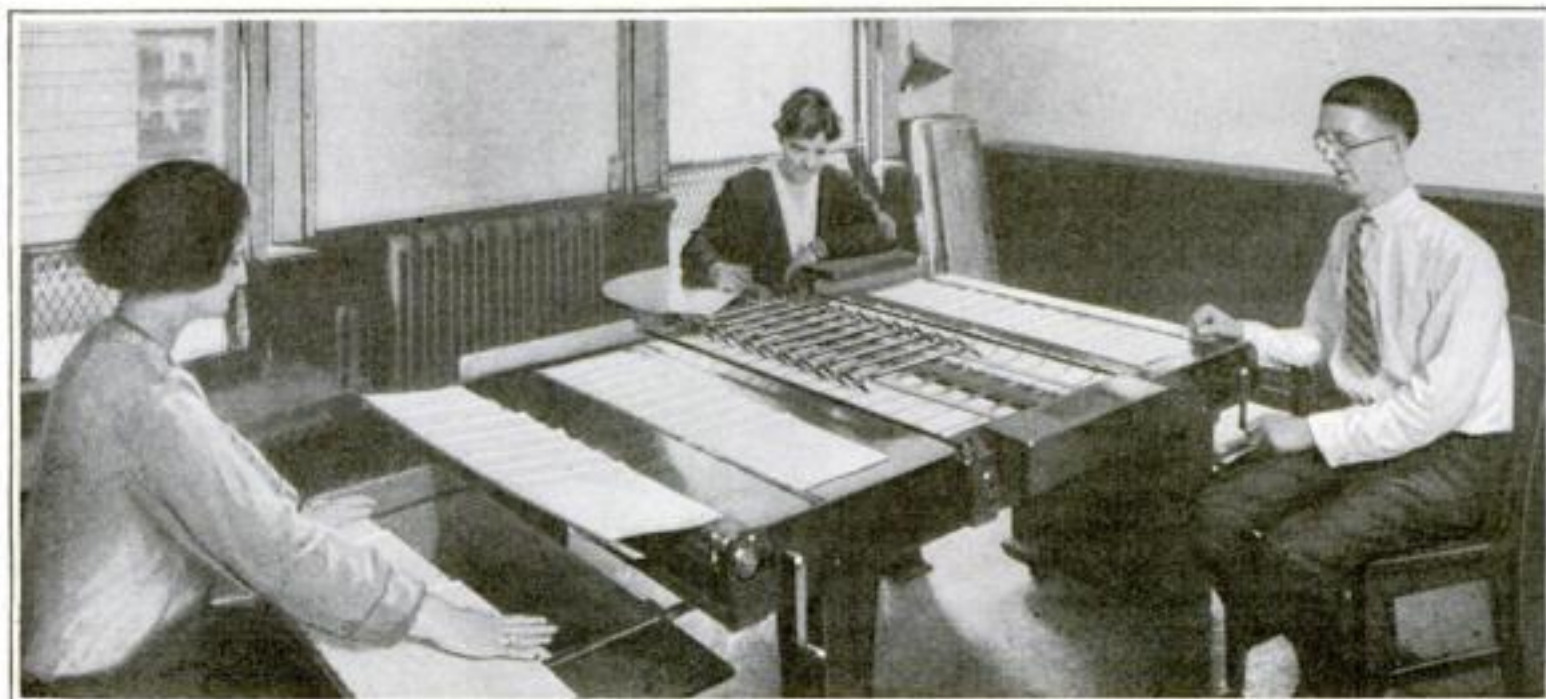
Above may be seen the "radio pen" receiver hooked up to a regular radio set. Just over the novel instrument, at the left, is a finished line drawing it has reproduced

series of levers, so that every movement of a tiny iron bar, mounted so as to replace the customary diaphragm, is communicated to the pen, causing it to touch the paper and make an ink mark.

As radio impulses actuate the magnets and depress the bar, the pen also is depressed, and, as it is drawn across the paper by a radio-controlled motor, a line is produced. These ink lines, properly placed, form the completed picture.

The radio impulses are generated by a similar-appearing machine at the broadcasting station. The difference in the transmitter is that the lines of the original drawing, either done in metallic ink or etched on zinc, form an electrical contact between the points of the tracing stylus, making and breaking an electrical circuit, which is broadcast in the usual way. The drawing is shifted downward after each sweep of the stylus.

Signs 11,564 Letters in Two Hours with Unusual Device



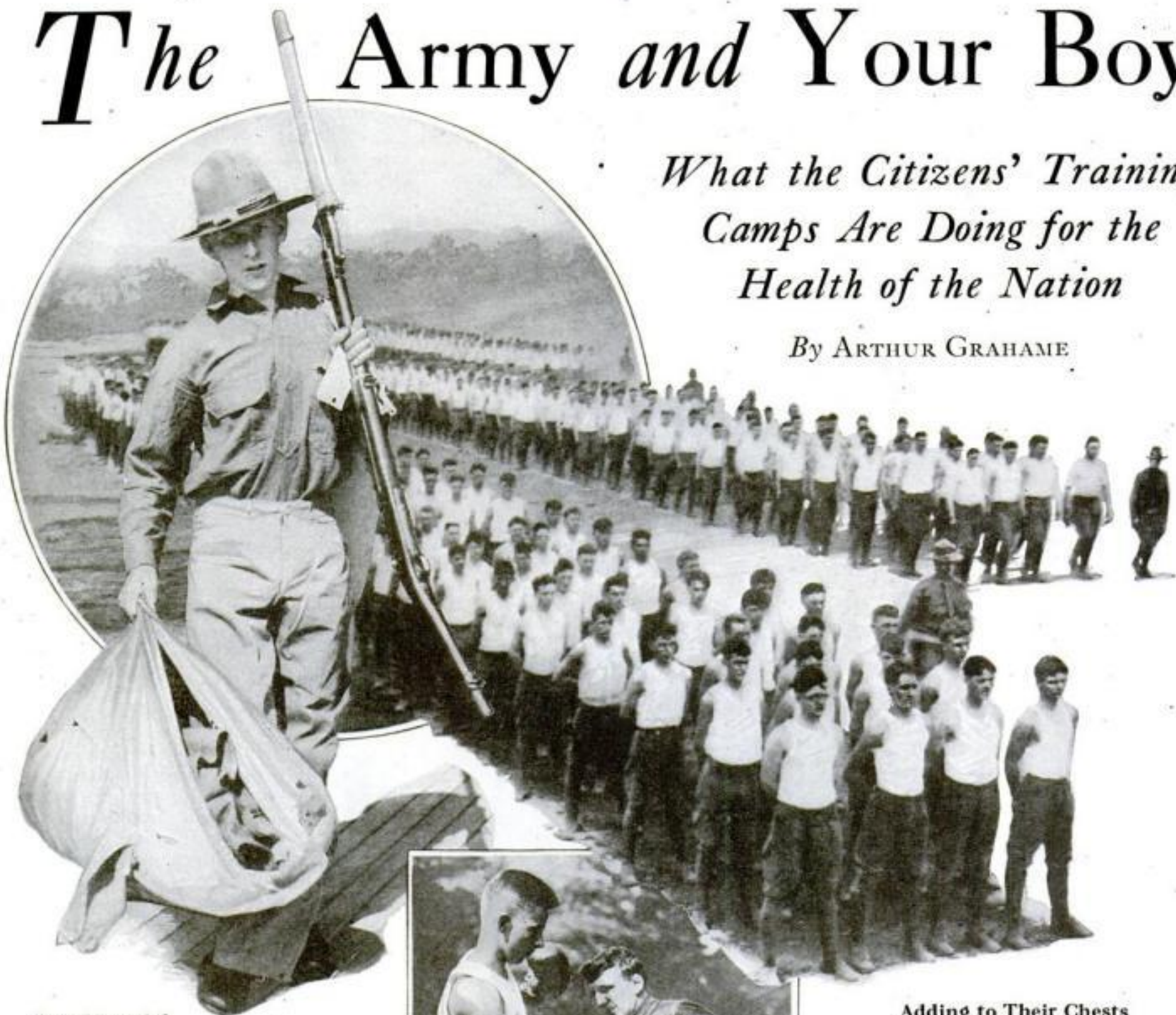
SIGNING 11,564 letters in two hours was no exhausting task for Miss Gertrude Robinson Smith, president of a national women's club, aided by an ingenious device called a signagraph.

Each stroke of her pen set in motion twenty little fountain pens, working simultaneously. Two assistants aided her, one to feed letters to the machine twenty at a time, and the other to take them off when they were signed.

The Army and Your Boy

What the Citizens' Training Camps Are Doing for the Health of the Nation

By ARTHUR GRAHAME



Raw Material

Here is a typical "rookie" on his first day in a citizens' training camp—pale, awkward, uncomfortable in his ill-fitting uniform. Before his month in camp is up, he will be transformed into a smart, stalwart soldier

*Don't send me home, please don't
send me home!*

Tell me what I ever did to you,—

Oh, oh, oh, oh! have a little pity!

I'm a poor candidate,

In search of war I roam.

I'm with you in most anything you do,

But please don't send me home!

SO, IN plaintive chorus, sang the students attending the war-time officers' training camps nine years ago this summer. Life in these camps was no restful ride on balloon tires, as I can testify from personal experience; but it had so many compensations that one's chief worry was to win marks good enough to keep from being "sent home."

Within a few months, 35,000 young Americans will be spending a month each in the citizens' military training camps that are direct descendants of the first Plattsburg camp, father of the war-time training camps. They will have even better cause to plead not to be "sent home" than did those hard-driven men of the A. E. F. who went before them.



Where He Learned to Box

John Coolidge (left), son of the President, who recently took part in the Amherst College boxing tournament, is seen here sparring with Captain Freddy Welsh, a former champion, at Camp Devens, Mass., last year

In the camps of today, the nerve racking drive of the war camps is absent. Grim-faced learners of the business of war are replaced by grin-faced youths having the time of their lives, for the Army has turned from training youth for war to training youth for peace—to instructing young Americans in the duties of citizenship, to building up their bodies by drill, exercise, and outdoor sports; incidentally giving them without cost a much better vacation, and a more beneficial one, than money could buy.

Adding to Their Chests

Every day the amateur soldiers take calisthenic exercises in the open air. The result is that the average gain for each man is thirteen pounds in weight, one fourth inch in height and half an inch in chest measurement

These citizens' military training camps are conducted by the Army under the provisions of the National Defense Act of 1921. They are, as President Coolidge has pointed out, "essentially schools in citizenship." The basic, or first year, course consists of physical training, instruction in the duties and responsibilities of citizenship, instruction in hygiene and first aid, drill, and rifle marksmanship. Less than half the 110 hours of instruction are devoted to purely military subjects.

This summer, soldiering seems destined to have an increasingly beneficial effect on the general health of the nation. Last summer, 33,500 men between the ages of seventeen and 31 attended the camps. More than half of those who applied for admission were high school students.

A DIRECT result of the thirty days of healthful living and careful training was an average gain in weight of four pounds, an average increase in chest measurement of between one fourth and one half inch, an average increase in

chest expansion of nearly an inch, and an average gain in height—the result of corrected posture—of nearly one fourth inch. Another direct benefit was inoculation against typhoid and paratyphoid, and vaccination against smallpox.

An indirect benefit that is beyond estimate was that every graduate of the camps took home with him a working knowledge of practical hygiene and habits of healthful living. Judging the future by the past, the bettered health of the 35,000 young men who will attend this summer's camps will be well worth the \$2,800,000 that Congress has appropriated for their upkeep.

"THE candidate begins to draw health dividends from the citizens' military training camps the moment he applies for admittance," Major-General M. W. Ireland, surgeon-general of the Army, told me. "In making his application, he must undergo a preliminary physical examination by a local physician. Frequently this is the first real health inventory he ever has received. Often, too, he is told, for the first time, that he possesses remediable physical defects. Minor physical defects of this remediable type are common. Half of the men examined under the Selective Service Act had them.

"In camp, he receives other dividends—inoculation against disease and a physical examination by medical officers especially trained in this work. These examinations have shown that about four per cent of the men sent to the camps have physical abnormalities that would not permit them to undergo military training. They also have shown that forty-four percent of the men enrolled in the camps had minor physical defects which could be remedied.

"BUT it is when he begins his actual training that he draws his biggest health dividends.

"As a rule, the youth who enters a citizens' military training camp is a healthy young animal, ignorant of the means by which his physical well-being may be maintained and improved, and heedless of the future so far as his own health is concerned. Often he is slouchy, careless and soft muscled. Thirty days

later he goes back to civil life well set up, muscular, and with new ideas about the importance of devoting some thought and effort to maintaining his physical fitness.

"I have seen raw, untrained boys and men after thirty days in a camp parade before the President of the United States in a manner that would have been creditable to seasoned troops.

"A Medical Corps officer on duty in one of the middle western camps last year was telling me only a few days ago of the almost magical transformation worked in some of the men and boys who passed under his eye. There was a fat boy of seventeen, for example, whom everybody in camp called 'Tubby.' He didn't want to go to camp, but his father had insisted. His natural physical aversion to effort, coupled with his indignation at what his father had done, made

him a poor example of a soldier for a few days. Then he suddenly awakened to the fact that one who shirked in camp became frightfully conspicuous, so he began to enter into the drills and the physical exercises with a little more spirit. Likewise he became conscious suddenly of a queer change in his physical feelings. He didn't know it, but the change was due to the unaccustomed exercise and the absence of sweets from the camp mess.

Army Shoes Don't Pinch

Feet spread and swell under the unusual use they get in camp, so shoes must be fitted scientifically. At right, a medical officer is seen measuring a recruit's foot as it spreads under the weight of the two heavy pails of sand he is seen holding



Playing War

This typical scene at the Plattsburg, N. Y., camp shows a squad of recruits firing a machine gun at a target some 800 yards away



Long hikes through the woods are part of the routine of every citizens' training camp. They are not taken, though, until the recruits are hardened; otherwise, blistered feet might result

"The fat that he had been accumulating for years began to melt and his clothes became loose. Eight pounds disappeared in the first ten days. At the end of thirty days, Tubby had lost twenty-four and a half pounds—and his nickname. Moreover, he's going back to camp this summer.

"There was another young man, older than Tubby, who went to camp two years ago because he had nothing better to do. He was one of those good-natured lazy fellows who never seem to accomplish much because they never stick at anything long. He had been unsuccessful in school; his business career had been a succession of jobs lost through incompetence. At camp, for the first time in his life, he had to do the things that would build up his body, strengthen his muscles and make a man of him.

"Stimulated by (Continued on page 138)

A Dozen Tips on Remodeling

You can find sturdy construction in old ruins, but comfort usually is a result of your ingenuity

By JOHN R. McMAHON



Made a Century Younger

This charming Dutch colonial dwelling at Cedar Grove, N. J., was remodeled from the 100-year-old cottage in the picture below

IF YOU want a home quickly and at moderate cost, you don't have to build a new house. Buy an old place, move in, and tinker and doctor it up when and as you please. A barn will make a dwelling, even a stable is not to be sneezed at. Frequently the worse the ruin the more chance for a clever job, and the greater the credit for the transformation.

Remodeling old houses is popular in America. Formerly folks were somewhat apologetic about second-hand, tinkered domiciles. Today, thanks to the example of our "best people"—the artistic as well as the moneyed—it is good form to live in an old building. An abandoned church, a lighthouse and a chicken coop have been converted into homes without bringing social stigma.

In the East, colonial ruins are favored. An architect is hired—but not to raise the low ceiling or to multiply the scanty windows or to throw several cubby-holes into a few spacious rooms. He dare not desecrate the makeshifts of our pioneer sires with obvious modernity. His task is to keep everything seemingly two centuries old, while he cunningly hides the essential improvements in plumbing, heat and light. The grand old fireplace yet pretends to be useful, but there is steam heat in concealed radiators. Candles are alight, but the illumination comes from masked electric lamps.

Such a house is only excusable as a historical relic, like Ford's Wayside Inn. Our ancestors themselves would laugh at us for squeezing ourselves into their primitive dwellings. It is indeed desirable to keep the general lines of an

When You Remodel:

1. Make a cellar, if there isn't one, by lifting house or digging under.
2. Point up or face foundations with rich cement. Additions to walls can be built down as well as up.
3. Replace decayed sills and beams. Inspect all timbers subject to moisture.
4. Rebuild old chimney and put in flue lining.
5. Leave old shingles on roof, unless too curled. Cover with new material.
6. Let outside wall covering stay beneath new siding, shingles or stucco.
7. If there are no outside sheathing boards, put them inside.
8. Equalize floor levels; get rid of a "step up or down."
9. Put new flooring over old.
10. Lift low ceilings.
11. Increase light and air with more or larger windows.
12. Make larger rooms from cubby-holes by changing partitions.



The New Covers the Old

W. Pearce, 80-year-old mason, plastering a wall in the house shown above. Note the original mortise for supporting crossbeams and the "wane" stud, with the bark still on

old manse, but it is foolish to sacrifice comfort and sanitation for an heirloom effect.

There are arguments on both sides for remodeling versus building. You have to put up with what you find in a new ready-built house as well as in an old house; and many become dissatisfied with a made-to-order dwelling. Age is not important; the real factors are material, construction and the state of preservation. The present high cost of building is

perhaps the best argument for the old house, reasonably bought. Remodeling should not be as expensive as all new work, and it need not be done all at one time.

Other things being equal, of two dwellings twenty-five and 100 years old, I would be inclined to choose the latter. The more recent house is balloon framed, that is, built of light timbers. The ancient specimen is of heavy construction. The woodwork is often oak, walnut and white pine. On the other hand, the older house generally needs more interior re-



What skill and ingenuity can accomplish was exemplified strikingly in the transformation of this ancient cottage into the modern home at the top of the page

Old Houses



The Good and the Bad in the Homes of Other Days

Old houses are usually of sturdy construction, but, as shown at the left, ceilings and doorways may be uncomfortably low. Above, workmen are shown in the act of removing the old roof from the house on the opposite page after the new roof had been built above it.

modeling than the more recent dwelling. Much of the advice given in a previous article of this series on sizing up a new house applies to an old structure. Examine everything from cellar to roof. Figure out how much remodeling you want, and add the probable cost of changes to the price asked for the dwelling. You can get an estimate from a carpenter on the expense of remodeling—and then do as much of the work yourself as possible.

The lack of a cellar is usually the first problem that confronts the buyer of an old house. There are several ways to remedy this. You can dig out the earth under the structure, move it to a cellared site, or raise it to provide a basement. The last is done often to give the living floor the benefit of dryness, light and view. It may be the only solution where the site is rocky and cannot be excavated.

IT IS best to have raising done by skilled workmen. They know how and have the needed powerful jacks, massive beams and prop timbers. They can elevate a house, chimney and all, without cracking the plaster to any extent or doing other damage. Usually the house is lifted a few inches above the desired height and afterward lowered to rest on the new cellar or basement walls. Such walls generally are built of solid concrete or of concrete blocks. Except for the footings, an eight inch wall is enough, according to government experts, though local building codes may require ten or twelve inches. On firm soil the concrete footings may be eighteen inches wide and a foot deep.

Lately I saw a bungalow raised and provided with a complete basement. Kitchen and bathroom were placed downstairs, and a dumbwaiter carried food to the dining room above. A new foundation was built under the elevated

base of the old chimney. An extra tile-lined flue was added to the chimney, supported rather ingeniously by a well reinforced concrete shelf.

It is a long established belief that walls must be built from the bottom upward. This is a fallacy, according to a neighbor of mine. He bought a cellarless house whose foundation walls extended about three feet in the ground, and since these were of good concrete he did not want to demolish them in making a cellar. As an engineer, familiar with tunnel work, he was not long in devising a method.

He excavated enough to place wooden props every four feet under the old foundations. Then he dug away the rest of the earth, made forms continuing the old foundations to the level of the cellar

floor, and filled them with concrete. The wooden props were left imbedded in the concrete, where they are as imperishable as the material that surrounds them.

OLD cellar walls, laid in lime mortar and even mere clay, can be restored by "pointing up" the chinks with a rich mixture of Portland cement and sand. It is better yet to plaster the whole surface with about two and one half parts sand to one of cement. Where the wall is very uneven, has large chinks, and the site is wet, it is a good scheme to build a vertical form about four inches from the wall and fill with sloppy concrete or grout. Use only small gravel or crushed stone in the mix and ram well in place.

This will fill every crevice and make a smooth, hard, water-tight surface.

The ancient chimney, without flue lining, is a fire menace and is best torn down. Doctoring it with cement outside is not much use. Everyone should know that flue lining, made of special fire-resistant clay, is the only safe material.

The decayed sill, the first and lowest house beam, often resting on a damp foundation wall, may have to be replaced. So too the first floor beams that are exposed to the moisture of the cellar or of the unexcavated ground. Dig in with a penknife and the apparently solid wood shows itself punk. Perhaps the decay is superficial and will not continue with improved conditions of dryness and ventilation. We might replace the worst joists and put a new girder under all, with iron column supports. It would be well to scrutinize the old wooden posts.

The mystery of why one beam rots quicker than its immediate neighbor was revealed to me recently when I looked over a house of the vintage of the 1830's. The pioneer builder had obtained his lumber from the trees standing around the site and had not been



Courtesy M. B. Moran, Architect

How an ordinary farmhouse at Watermill, N. Y., was remodeled at little expense into a stately colonial home. The taller porch pillars worked a magic change in appearance



Letting the Light into an Old
New England House

The possibilities of the typical old New England house at the left above with its ugly porch that darkens the rooms of the lower floor, were realized when it was remodeled into the comfortable home at the right.

Courtesy
L. B. Welch
Architect



Removing the porch and adding a wing made the house graceful, bright and roomy. If you are lucky enough to find a house of fundamentally sound structure, such remodeling is usually worth-while

particular in his selection. He cut down an oak, next a tulip tree, then hickory, hemlock and sycamore—whatever was handiest. Enough bark was left on the hand-hewn timbers to help identify them. Naturally the perishable whitewood or tulip could not stand cellar moisture as oak does, and some chestnut joists endured much better than hickory.

The more recent dwelling is generally built of uniform material, but this fact should be verified; and uniformity may not spell the best choice of lumber. You are in luck when you find first floor beams of oak, chestnut, spruce, long leaf yellow pine or the like.

WHAT shall we do about the old, leaky shingle roof? It used to be the practice to rip off the old material and shingle new. We now see the advantage in heat and cold insulation, as well as in labor saving, by leaving the first covering on—provided it is not too warped or irregular in surface—and adding a new top. There are many kinds of roofing to choose from, between asphalt, asbestos and copper.

Doubling the top is no mere theory. The old-time shingle roof is only a slight protection against the elements, nothing being under the shingles except nailing strips across the rafters. No wonder icy air flows through the attic in winter and chills the house.

The better sort of roof as built now consists of three layers—matched sheathing boards, next felt and then the final covering. The underwriters tell us that wood shingles are always a fire hazard. If you must have them, select the best quality, extra thick and hand split.

Let the old wall covering of your house stay in place and cover with new siding, shingles or stucco. The usual object of adding a new outer surface is to make up for lack of sheathing and to improve the appearance of the house.

The other day I saw an interesting job of this kind done on a barn converted into a dwelling. A previous occupant had begun to remodel the barn, applying siding direct to wall studs. The present owner decided to add stucco to the lower half and shingles to the upper part of the exterior. For the stucco job he nailed lath vertically a foot apart to the siding.

Have YOU a Building Problem?

THIS is the third of a series of articles on home building by an authority of national reputation.

To make this series still more helpful, Mr. McMahon places his experience at the disposal of readers interested in home building. If you have a problem, perhaps he can help you. Address John R. McMahon, care POPULAR SCIENCE MONTHLY, 250 Fourth Ave., New York, enclosing stamped, self-addressed envelope

Then he stapled to the lath galvanized wire mesh of one third inch spaces, and to this he applied the stucco.

If there is no sheathing on the outside of a house, it is a good scheme to put it inside, if the interior is not lath and

plaster, as in the half finished dwelling or summer cottage or extensions. Either put the sheathing directly on the studs or over fiber board. This strengthens the wall and also makes it warm and dry. The inner sheathing may be covered with fiber board or it may be "furred out" and covered with plaster board, wall board or regular lath and plaster. In the latter case a moistureproof building paper should be tacked under the furring strips. Usually common North Carolina pine boards, shiplap style, eight inches wide, serve for sheathing.

THE walls of a frame house normally consist of four layers of material on the studs or uprights—the outer covering, building paper, sheathing and finally some sort of interior surfacing.

An amateur remodeler I know thought he could improve on this combination, and built six-layer walls. The added elements were inside sheathing and beneath it, on the studs, an extra layer of asphalt roofing instead of building paper. For his ceilings he used twice the usual number of materials, that is, first sheathing, then asphalt roofing, next "ceiling" of thin matched boards, finally fiber board. Such a house would withstand the rigors of an arctic climate, and in a mild region takes very little coal to heat in winter and is always cool in summer. A noteworthy feature is the use of inner sheathing to give a rigid back to fiber

board, which is a rather weak and warpable surface as ordinarily applied to studs or joists. With this method, fiber board stays flat and is as solid as its base.

If the old house has different floor levels, a step up to the parlor or one down to the kitchen, the levels may be equalized by laying on the old flooring sleepers or joists, on which new floor is nailed. Lowering the original joists and replacing them on the foundation

(Continued on page 125)



Courtesy Atlas Portland Cement Co.



Remaking an Old House with the Aid of Cement

These two views of a New Hampshire dwelling, before and after remodeling, illustrate the amazing change in appearance that can be wrought by making a few slight structural changes and finishing the exterior with cement. The methods are applicable also to smaller structures

Only *the* Daring Work *for* Him

A Single Slip Means Death to Eddie Ward's Pupils

By EARL CHAPIN MAY



Miscalculation of a tenth of a second may mean a broken neck for the flier who accomplishes somersaults, shown above, forty feet over the heads of circus crowds

Fliers and Catchers

A group of aerialists who flirt with gravity twice a day. Eddie Ward, their teacher, is second man from the left

The Training School

The rebuilt barn, right, in Bloomington, Ill., where Eddie Ward teaches his hazardous profession to boys and girls



Above: Eddie Ward, a butcher boy at eleven, and today at 38 the teacher of America's best circus aerialists. He taught himself as a boy on a backyard trapeze

IF YOU have witnessed a circus performance in the last four years, you may have seen the Flying Wards swinging, diving, and pirouetting in the air beneath the dome of the billowing big top, while the circus band played a lilting waltz and the towners on the blue seats gasped and applauded. If you have seen these young men and women gliding gracefully from perch to trapeze bar, to catcher's hands and back to perch again, and nonchalantly taking the chances on broken bones, you have witnessed the "flying return act," feature of the big show.

Eight of the Flying Wards are "working" in a steel rigging suspended over one ring. Eight other Flying Wards are "working" in a similar rigging, suspended over another ring. For twelve minutes they have "stopped the show": they have had the tent to themselves.

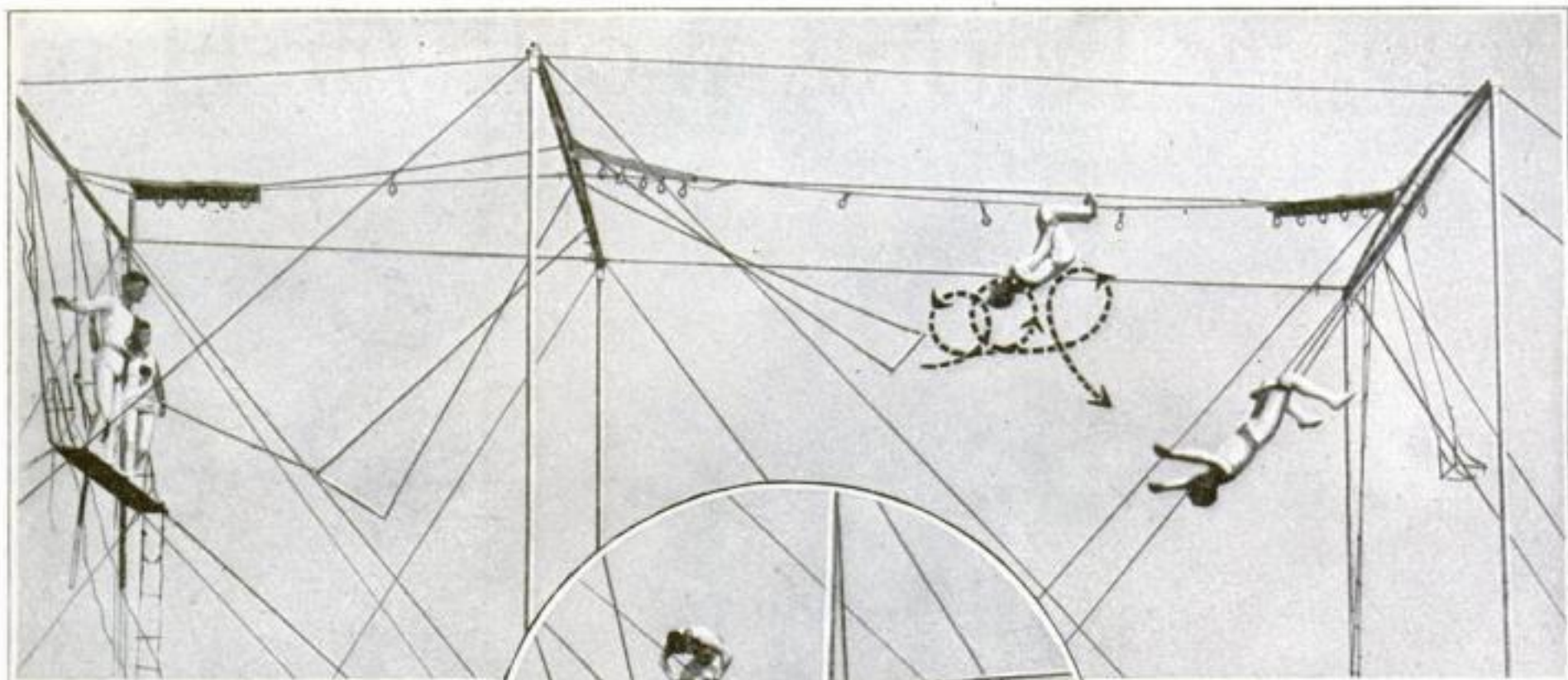
Finally, as they dive into the net

stretched beneath each rigging, swing from the net to the ground, "line up" and "take their bow," you may notice a heavy-set, blond young man with deep chest, thick arms, and broad shoulders glance with approval at the row of trim-built gymnasts in white tights who are sharing the plaudits. That's Eddie Ward, chief of the Flying Wards.

Eddie Ward has been a circus aerialist for twenty-seven of his thirty-eight years. He has "broken" more than fifty boys and girls into his exalted branch of the circus profession. He has more than thirty "fliers" and "catchers" on his payroll. He is one of the master minds in the world of sawdust and spangles. He has earned, saved, and invested his money until he is worth \$150,000. He has made his own way since he was seven years old. And he started on a homemade backyard trapeze!

"You see," says Eddie, "I had to begin supporting my mother and sister when I was seven. I got a job in a meat market and sold newspapers on the side. But I was a healthy kid. Mother's uncle had been a circus performer in Europe. There was a thorn apple tree in our backyard at Bloomington, Illinois. My sister was two years younger than I, but husky, too. We rigged up a trapeze on the thorn apple tree and rehearsed an act.

"We got our first professional job when I was eleven years old. It was at the Atlanta, Illinois, county fair. Our salary for the week's engagement was fifteen dollars. To increase our income, we passed the hat. We took in four hundred and fifty dollars that week. When I turned that fortune over to mother, she told me to quit the meat market and paper route and go into the circus business. I have never passed the hat since then,



The Greatest Thriller of All

The most dangerous and spectacular of all aerial tricks—the triple back somersault from trapeze to catcher—is shown above. The flier, whose path is shown by the dotted line, can control his body during the first and second revolutions, but not during the third

but the Flying Wards are the result.”

Eddie Ward is one of the greatest utility men in the business, and is always on the job to see that nothing untoward occurs. But, in between times, one gets Eddie's dramatic story.

“I've taken a good many falls in my time,” he says. “Sister and I took a lot of them doing our old double-trapeze act. There isn't any net under a double-trapeze act. When any one lets go, the only thing to hit is the ground.

“I got to studying these falls, generally from a hospital cot, and made up my mind there was no future in the straight trapeze business. The salary was limited, the act was old. Flying return acts were just coming on. I owned ten acres and a house and barn on the edge of Bloomington. I rebuilt the barn and started studying falls into a net. When I learned that there isn't much to falling into a net when you light on your back or shoulders, I framed my first flying return act.”

The secrets of success in the flying return act, Eddie naïvely explains, are important though few. All that is required of the fliers or leapers who do single, double, and triple somersaults from trapeze bar to the catcher's hands is perfect muscular control, perfect judgment of time and distance, and the ability to figure on gravity. The requirements for the catchers—and Eddie is one of the catchers—are much the same.

ABOUT the only apparent difference between fliers and catchers is in weight and agility. The fliers must be aerial contortionists who know no fear. But the catchers do the timing. They say “Go” to the fliers. Each catcher, hanging head downward from a swinging trapeze, tells a flier when to leave the perch and when to cast loose from the trapeze bar and fly toward the catcher's outstretched hands.

If a flier, after whirling over and over through the air, is just able to touch his

catcher's fingers, that flier is out of luck. Gravity gets him. He keeps on flying and falling until he hits the net—or the ground. That's where Eddie's fine work comes in. He starts his boys and girls right, when they join his kindergarten class.

Even the stars of the flying return act, who are the stars of the gymnastic world, begin professional life as “carpet acrobats,” learning back bends, handstands, handsprings, and round-offs. The last are handsprings started facing backward and ended facing forward. They learn backward somersaults on the ground, with a safety belt or “mechanic” strapped around the waist and held by two old-timers. Then they are taken into the rigging and learn to fall into the net and to do flying tricks and fancy dives, still with the protecting belt attached to a block and tackle, keeping them from breaking arms, legs, or necks.

Eddie Ward, student of gravity since he ceased to be a butcher's boy, was one of the first, if not the first, among teachers of circus fliers to rehearse aerial stunts with a safety belt around each flier.

“When I learned the business,” he told me, “fliers took long chances when they tried aerial stuff. If they were diving or falling into the net, they *might* not strike face forward and break their neck, and again they might. If they missed a catcher's hands, they *might* land in the net on their shoulders and get only a few welts from the ropes, or they *might* hit it before they had completed a turn, and so break a leg or worse. I don't care who it is, if he gets all jammed up while trying to master a trick his nerve isn't so good after that.

A Triple Back Somersault

Thus it is up to the catcher, swinging upside down, to calculate exactly just when the flier's body will meet his, for the flier must clasp his wrists while going forty miles an hour. The circular picture shows Eddie Ward, seated on a trapeze, in the act of coaching two acrobats

“When I take the safety belt off, my fliers haven't any fear. They know their business. If they do miss a catch, they usually are clever enough to land right—unless luck is against them.”

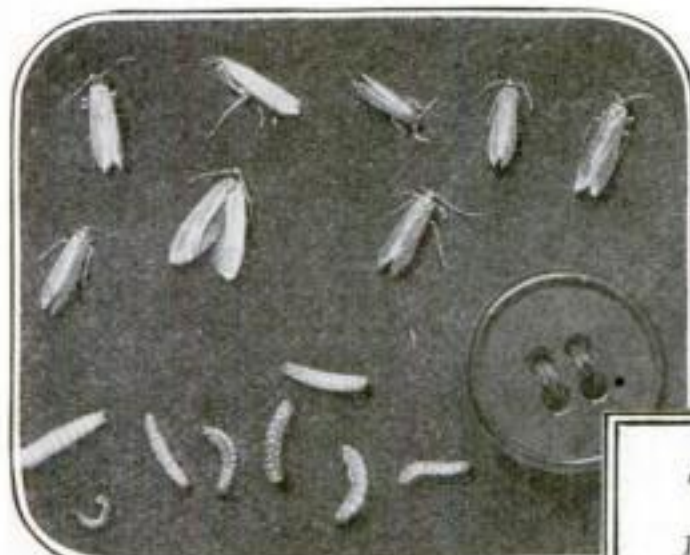
The catcher is the flier's only insurance, for the flier is regarded as a poor risk by casualty companies. As the catcher swings backward and forward on his trapeze, forty feet from the flier's perch, he must know, although he is upside down, when to say “Go” to the flier. He must calculate to a nicety just when and where the flier's revolving body will meet his, for the flier's hands must clasp his wrists while the flier is going forty miles an hour.

THERE are many varying conditions to be considered. It may be a bitter cold spring day with snow on the big top. That slows up the gymnast. It may be a terrifically hot day with a temperature of 135 degrees in the dome of the tent. That means perspiration and slippery hands and wrists, in spite of extra resining and wrist wrapping. Eddie lost the best flier he ever trained because perspiration interfered with a perfect performance, and because the flier was attempting the most desired and dangerous of all fliers' tricks—the triple back somersault from trapeze to catcher.

The flier was Ernest Lane, who had done the “triple back” in circus tents and on fair grounds a hundred times. He had everything to make a flier—splendid control, perfect nerve, ideal weight, extreme agility. But while rehearsing for the spring opening at Chicago in 1920, Ernest let go the trapeze a little before he intended to—slipped off, in fact. A flier can control his body during the first and second revolutions, but not during the third. Lane's groping hands, as he flew along, missed Eddie's outstretched hands. Eddie, resorting to an old trick of the trade, struck at *(Continued on page 133)*

Hungry Moths Cost Us Millions

How to Save Your Clothes from Wool-Eating Pests



Clothes moths (above) and larvae or worms (below). The worms do the damage by eating the garment. Comparison with the button, which is $\frac{3}{16}$ -in. in diameter, gives an idea of their size.

By G. B. SEYBOLD

"GOOD for another winter," you comment with satisfaction as you pack away your overcoat.

But next fall—will that satisfaction be turned to dismay? Hole here, hole there, in the most conspicuous places! Will your winter wardrobe contribute this summer to the menu of the greedy and destructive clothes moth? The descendants of one single female moth can destroy 100 pounds of wool a year—equivalent to the wool produced by thirteen sheep. Annual damage done by moths in the United States is estimated at the amazing sum of \$200,000,000.

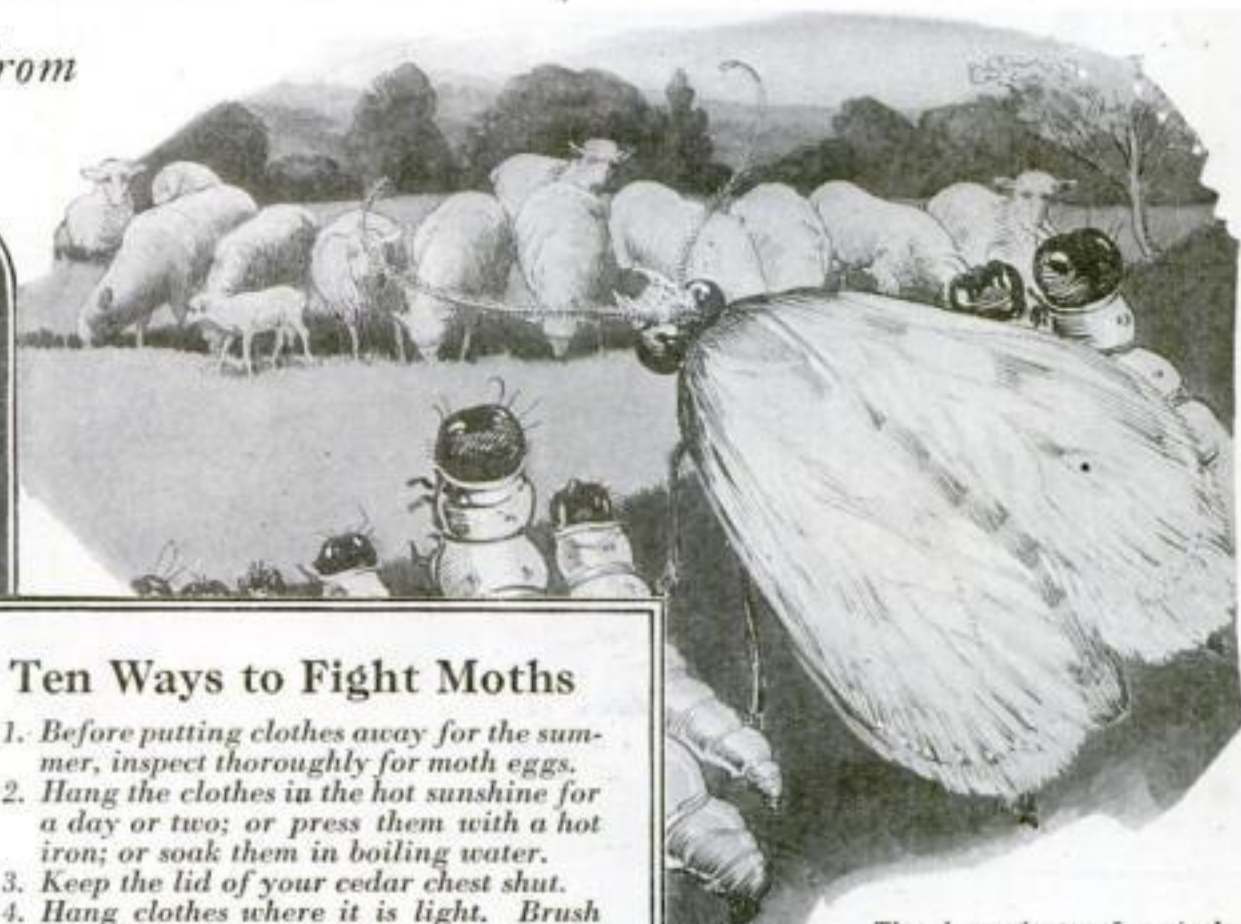
And it is not on wool alone that the moths feed. A fur collar is a nice morsel.



Before putting clothes away, hang them exposed to the sun and beat them thoroughly.



Moth balls or flakes packed with clothes in a tight container will kill all the pests.



The descendants of a single female moth can destroy in a year the amount of wool produced by thirteen sheep—in the neighborhood of 100 lbs.

Ten Ways to Fight Moths

1. Before putting clothes away for the summer, inspect thoroughly for moth eggs.
2. Hang the clothes in the hot sunshine for a day or two; or press them with a hot iron; or soak them in boiling water.
3. Keep the lid of your cedar chest shut.
4. Hang clothes where it is light. Brush and shake them twice a month.
5. If possible, use air-tight containers such as paper bags, sealed pasteboard boxes, or paper wrapping, for storage.
6. Pack clothes with moth balls or flakes.
7. Fumigate moth-infested closets with carbon disulphide or carbon tetrachloride.
8. Furs should be brushed, beaten, and aired thoroughly every two or three weeks during the summer.
9. When your clothes grow old, give them away. They are fine homes for moths.
10. Every time you see a moth, swat it.



What greedy moth worms did to an aviator's fur helmet. Not satisfied with eating away all the fur, they devoured part of the leather section, too. Note the moth cocoons above the visor.

Hair and feathers are special favorites. To outwit your enemy, the clothes moth, you must be on the alert constantly. Now, while storing your clothes, you can fight best.

The millers flitting about your light are not the guilty ones. They feed on vegetation, and will not touch your clothes. But look further, and in the darkened corners of the room you will find the clothes moth, a small yellowish or buff colored creature that measures only half an inch from tip to tip when its wings are spread.

In itself it is harmless. It won't bother your fur coat, because it can't eat. Its mouth is imperfect so that it cannot chew.

But it can snuggle in the fur and lay eggs that will hatch in from four to eight days in the warm spring weather into worms that will do tremendous damage. As soon as the caterpillar hatches from the egg, it begins eating your clothing.

Before you put away your clothes for the summer, inspect them minutely for concealed moth eggs. The tiny white eggs, smaller than a pinhead, crush easily. A thorough beating of your coat will destroy them. Turn the pockets inside out and inspect the seams.

Heat, likewise, will do the work. Hang all your clothes (Continued on page 134)



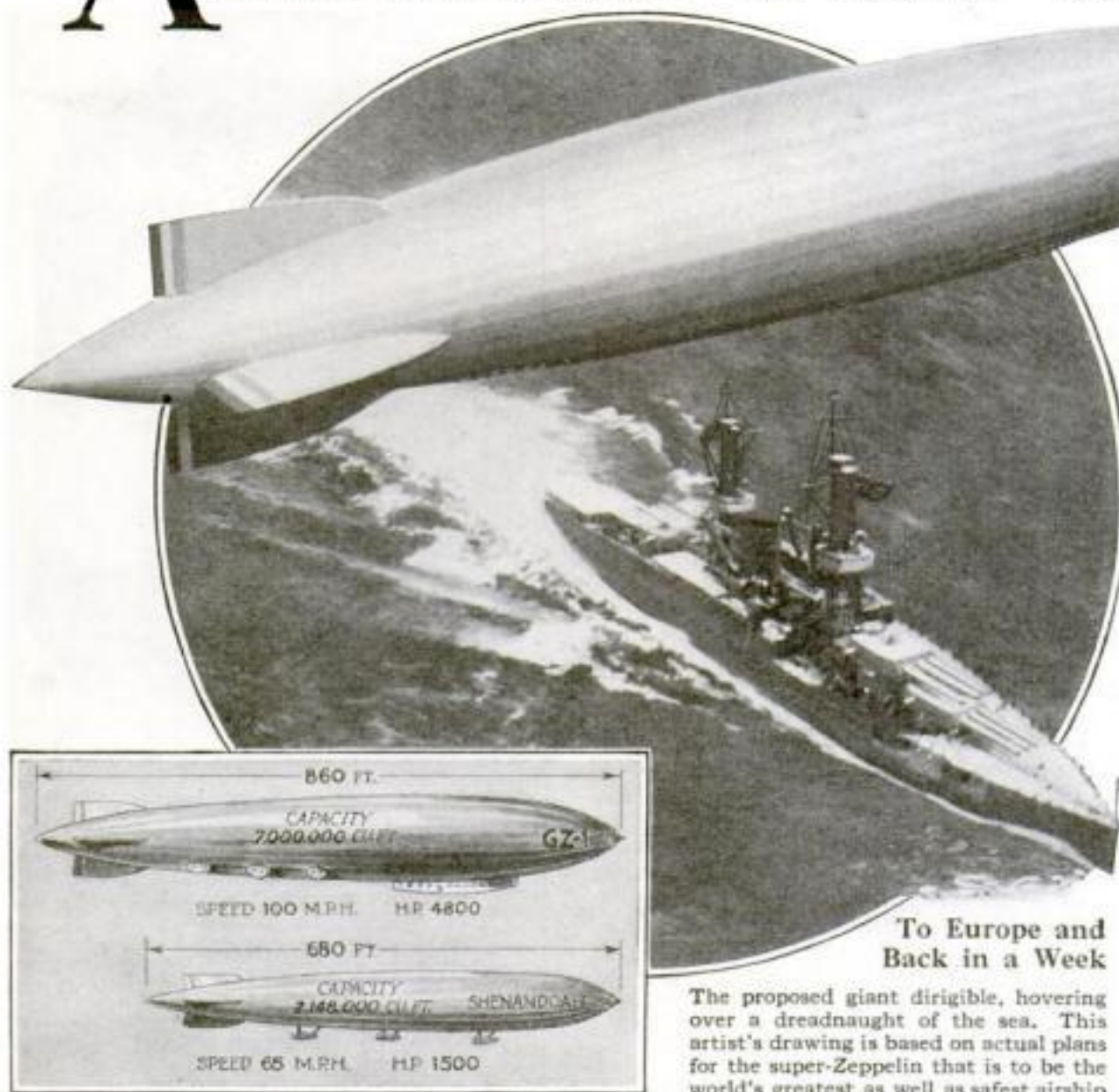
The simplest precaution is to store clothing in air-tight paper bags, tightly sealed.



Pressing with a hot iron kills any moth larvae in garments.

Americans Plan *the* World's

By
JOHN K. MARTIN



To Europe and
Back in a Week

The proposed giant dirigible, hovering over a dreadnaught of the sea. This artist's drawing is based on actual plans for the super-Zeppelin that is to be the world's greatest as well as safest airship

NEAR the village of Ava, O., lay a storm-shattered mass of wreckage—the ghastly corpse of what had been the world's finest dirigible airship. Torn asunder in the grip of the winds, the \$3,000,000 *Shenandoah* had crashed to earth, carrying fourteen officers and men to death.

In the wreckage, it seemed, lay the dreams of those of us who had placed in this proud ship our faith in the future of dirigible travel. For in the torn and broken hulk we saw but another repetition of the disasters that had befallen the greatest of the *Shenandoah's* predecessors. We recalled how the ZR-2, on its trial flight near London in 1921, crumpled and burst into flames, killing all but six of the British-American crew of sixty-six; how the Italian-built *Roma* exploded above Hampton Roads the next year, killing thirty-four; how the great French dirigible, *Dixmude*, vanished somewhere over the Mediterranean in 1923 with fifty souls aboard.

We remembered, too, the almost miraculous escape of the *Shenandoah* on that wild January night in 1924 when the gale tore her from her mooring mast at Lakehurst, N. J., and the equally dramatic runaway of the British R-33 which battled a terrific storm in the North Sea for thirty hours.

A record of tragedy and near-tragedy to discourage even the most optimistic believers in lighter-than-air craft! Yet in the face of it we are told now that in Akron, O., builders are preparing to lay the keel for the greatest airship the world

has ever known—a mammoth of the skies nearly three times as large as the *Shenandoah*!

How can such a ship be practical or even possible? How can its designers prevent another disaster even more terrible than those that have gone before?

For an answer to these questions I went to Akron, and there I found a little group of German experts at work under the direction of P. W. Litchfield, one of America's foremost airship authorities, making of this Ohio manufacturing city the Friedrichshafen of America. There I found Dr. Hugo Eckener, former head of the famous German Zeppelin plant at Friedrichshafen and commander of the *Los Angeles* (ZR-3) when she was delivered across the ocean to Uncle Sam. There, too, is Dr. Karl Arnstein, once chief engineer of the German plant, builder of the *Los Angeles* and nearly 100 other Zeppelins. And with them Captain

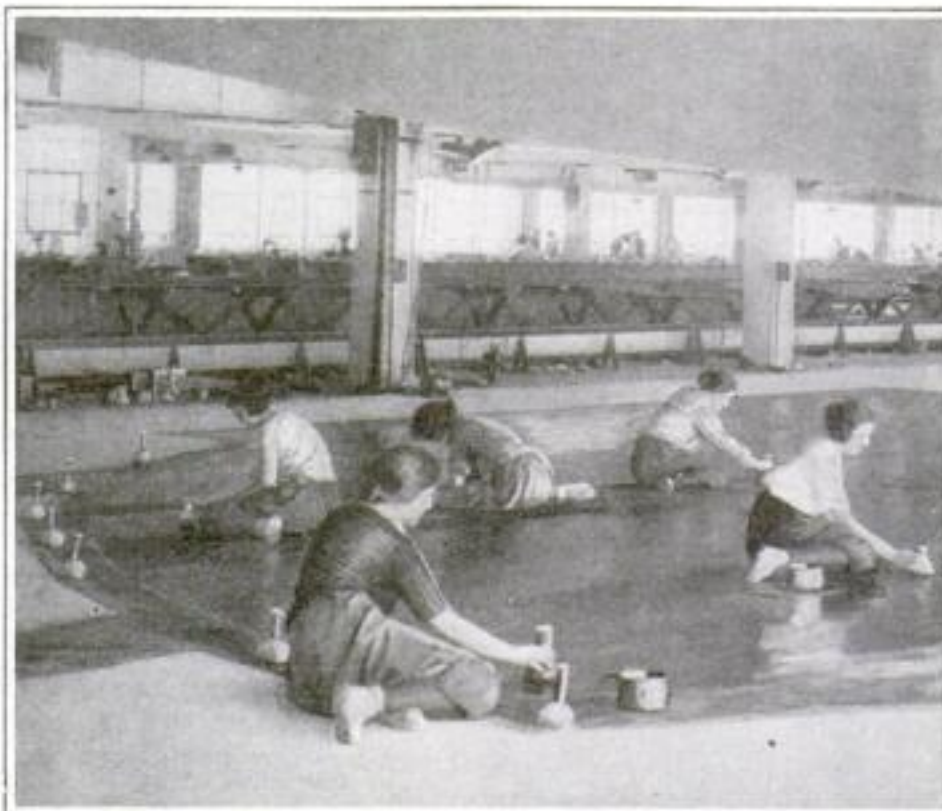
E. A. Lehmann, the German authority on airship operation and first officer of the *Los Angeles* on its historic trans-Atlantic flight.

Working side by side with a score of American engineers and designers, these successors of Count Zeppelin, I found, are contributing their expert knowledge gained through long experience in dirigible construction and operation. And all—Americans and Germans alike—are intensely bent on fashioning the super-airship—a ship to be not only the greatest but the safest ever devised, and to be known as the GZ-1.

NOR do they intend to stop there. Although the GZ-1 far overshadows any previous airship project, it is no secret that these experts already are considering plans for other ships even larger. And before many years, if their plans carry through, we may see whole fleets of aerial merchantmen transporting freight to every port in the world.

Every man at Akron is certain it can be done. And their confidence, as I soon discovered, finds expression in Litchfield himself, an almost boyish-looking man, whose vigorous frame and clear, searching eyes radiate healthy energy, tremendous enthusiasm, and undiscouraged optimism. As general manager of the new American Zeppelin plant, he is the forceful personality which is projecting the super-airship, and which purposes to make America lead the world in developing lighter-than-air craft for commerce. He is the Count Zeppelin of America.

"It is entirely possible," he told me, "to build dirigibles of the Zeppelin type



Photos
Goodyear
Zeppelin
Company

Preparing the gold beater skins for the gas cells of a Zeppelin in the Zeppelin factory at Akron, O. Varnish is applied to the skins to stiffen them and make them more gas-tight. Observe the size of these

Largest Airship

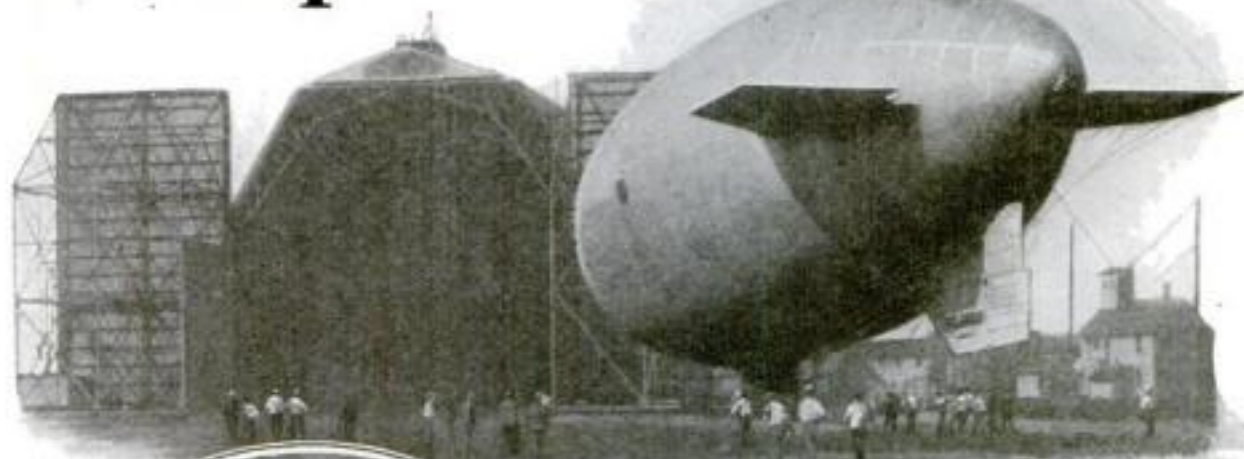
*The New Dirigible
Is to Be Three
Times Size of
Shenandoah*

many times larger than any yet produced; and it is possible to build them so that they will be absolutely safe. Engineers know that the larger an airship is, the greater is its efficiency in lifting power and cruising range. It is because of this that we have designed the new wonder of the air to eclipse even the two gigantic British ships whose keels will be laid this year.

THE GZ-1 will be solely a commercial ship. It will be able to circle the globe in any direction. Although it will be nearly three times as large as any previous airship, it will be easier to navigate. As for its safety, our engineering staff, which includes some of the world's leading authorities on the subject, have worked out the details so thoroughly as to exclude every possibility of a serious accident that might destroy it. In fact, we are so convinced of this that we would give a gold bond as assurance of its safety.

"Here is what the new ship will be like," he added, spreading on a table a number of plans and drawings.

If you were fortunate enough to have seen the *Shenandoah* before her fatal crash, shimmering majestically overhead, perhaps you may gain, by comparison, some idea of the tremendous proportions of the GZ-1. Imagine these two ships sailing side by side, rudder to rudder.



The Zeppelin of America

P. W. Litchfield, one of America's foremost airship authorities, planning to build a dirigible three times as large as the *Shenandoah*. "Airships can be absolutely safe," he says

The nose of the 860-foot GZ-1 would extend beyond the other the length of a city block. If both ships were resting on the ground, the top of the *Shenandoah* would reach only halfway up the side of the GZ-1, which will be 150 feet high. If placed on end, the GZ-1 would overshadow the world's tallest skyscraper.

This new aerial giant will hold 7,000,000 cubic feet of helium, compared with the *Shenandoah's* 2,148,000. It will carry enough fuel for a non-stop cruise of 6,000

miles. It will be driven at a maximum speed of more than 100 miles an hour, or eighty-five miles an hour against a strong head wind, by eight motors developing 4,800 horsepower—more than three times the power of the *Shenandoah* and sufficient, the designers say, to buck through the fiercest storm or to make a safe landing in the severest weather.

In shape and general appearance, the GZ-1 will resemble the American dirigible *Los Angeles* and the two 5,000,000

The Smallest Blimp

The *Pilgrim*, P. W. Litchfield's private airship, is only 110 feet long. It carries two passengers and is used mainly for research

cubic foot ships which the British government is constructing, except that it will be somewhat slenderer in lines. This feature, it is believed, will make it easier to handle, for the ship will present less surface to a head wind.

"But why," I asked Mr. Litchfield, "are you so sure that this magnificent ship will be any safer than preceding ones, or less likely to end in catastrophe?"

"I'll let Dr. Arnstein answer that," he replied.

This German technician is the chief engineer of the Akron Zeppelin plant,—exactly the same position he held at Friedrichshafen. He has every detail of design and construction at his finger tips, and he speaks to the point.

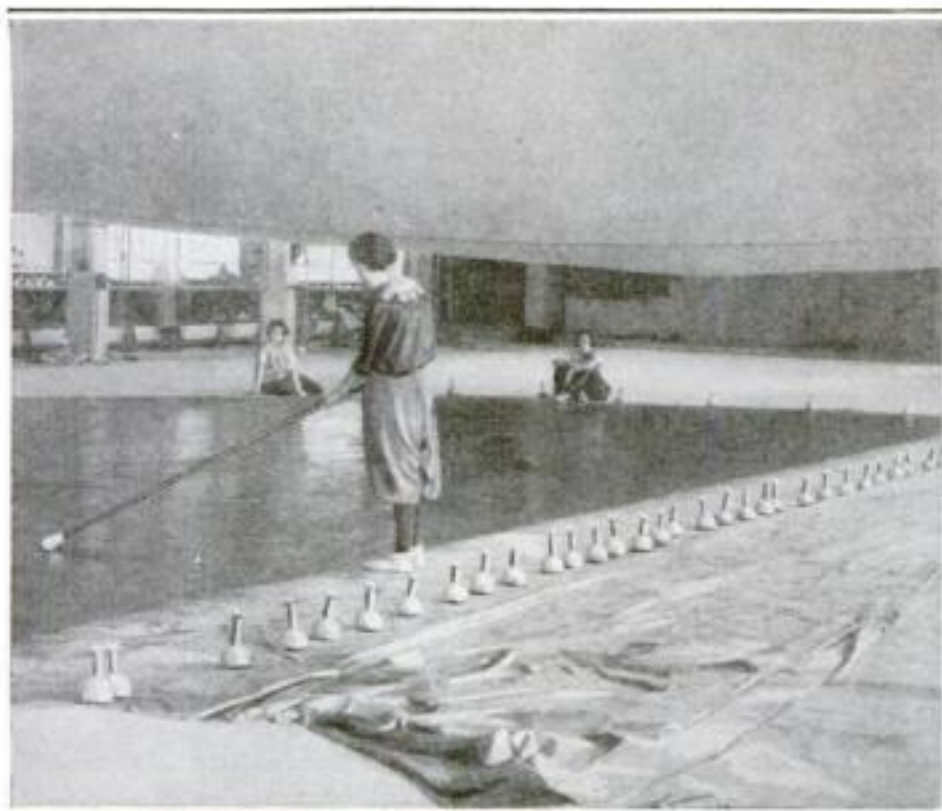
FIRST of all," said Dr. Arnstein, replying to my query, "we will use a new and improved duralumin metal which will give greater rigidity and strength to the superstructure of the ship. And, in the second place, the structural design of the GZ-1 will be radically different from that of any other yet built. Along the bottom, two corridors of lattice work construction will run the entire length of the ship. Into these 'backbones' will be built the circular ribs, also of latticed construction, which will support the envelope. Between the ribs will be interwoven steel wire bracing, forming a network of fine wires which will add to the ship's rigidity and hold the ribs in place.

"An advantage of this corridor arrangement will be that it will make the interior of the bag accessible from almost any point. Thus if anything should go wrong or any break should occur while the ship was in flight, it could be remedied instantly, preventing the possible development of a serious weakness in the structure."

But probably the greatest factor for safety, he pointed out, lies in the fact that the control cabs all will be built as integral parts of the superstructure, making it impossible for one of them to tear loose from the ship and cause disaster, as happened in the wreck of the *Shenandoah*.

"Engineers now are able to figure stresses so

(Continued on page 128)



bags and the care used in this process to prevent injury to them. The varnish is put on and spread with big soft wads, and the girls working on the job wear soft padded shoes so as not to stretch or tear the fabric

Can You Beat Them?

They Star in Unusual Stunts



Six Bull's-Eyes a Minute

Plugging the bull's-eye 2,499 times out of 2,500 shots—and all in six and a half hours—this seventeen-year-old youngster of Newtonville, Mass., recently hung up a new speed record for marksmanship on a fifty foot range. His name is L. Samuel Moore, and he is a champion with a 22-caliber rifle. A single doubtful bull's-eye robbed him of a perfect score. So rapidly did he fire that his overheated rifle blistered his hands



The Highest Tee

Anyone who wants to equal Theol Nelson's thrilling stunt is welcome to try. Just stand on your hands on the edge of the Hotel McAlpin roof in New York, and let Jack Rodmond, a golfer, drive a ball off the back of your head

A Wizard Typist

If you use the "hunt-and-peck" system of type-writing, you can marvel at the little nineteen-year-old English typist, Elinor Mitchell (below), who, in a recent contest, tore off 142 words a minute. She is the champion of Europe



Swims with Champion at Six

This little six-year-old speed marvel, Dorothy Wihr, of Chicago, can outdistance most women when it comes to swimming. Johnny Weissmuller, world champion, who is seen here coaching Dorothy in the crawl stroke, predicts she will break more than one world record



He Holds Six Matches on His Eyelashes

In the roster of movie queens, not one has yet been found whose languorous lashes can equal those of James Stranahan, nine-year-old boy of Brookline, Mass. His eyelashes are so long that he can hold six matches on them easily. Twelve is his record. His nearest rival is Viola Dana, the popular movie star, whose best performance is six. "That's a cinch," says James



Champion Whittler at 75

At 75, Edward P. Britt, of Mattapan, Mass., defies any owner of a pocket-knife to whittle from a single pine board a longer chain, with more links in it, than he can. He claims the whittling title of New England. Some of the things he has made out of plain pine blocks include an egg in a crate, three balls in a frame, and a traffic station with a policeman inside. He is still going strong



Where Movies Get Their "Props"

One Secret of the Films' Realism

ALL the "props" the motion-picture producer needs, to make his newest picture realistic to the smallest detail, he calls upon great costume companies to supply. In their huge warehouses, they have everything that anyone might want to give a film a perfect setting. Whether it be the elaborate costumes and gorgeous trappings for a wonderful historical production or the simple accessories of slapstick comedies, these companies have them in reserve.

The pictures on this page were taken in the twelve-story building belonging to one of the great costume companies of Los Angeles.

Here are some of the Indian feather headpieces that are so necessary for the popular western pictures



Masks for all occasions are in great demand, and a large supply, like the one pictured above, is generally kept on hand



The wonderful display, above, of Oriental goods of all descriptions occupies a whole floor a city block in area. It contains a priceless collection ranging from Chinese idols, vases and bric-a-brac to magnificent Persian rugs and silken draperies. It is typical of the great collections on which the movies may draw



The gruesome is also represented in the "prop" room. Skulls are frequently called for in medical and ghost stories, and various types are in stock

Every prop must be exact in every detail. The picture at the right shows an expert at work closely inspecting helmet plates for a new picture



An enormous stock of bottles, with labels more or less familiar in pre-Volstead days, is kept constantly replenished. They are needed especially for barroom scenes in old-time pictures. The attendant, seen in the above picture picking out some popular brands, is one of the busiest persons in this comprehensive establishment

Odd Bits from the Records

Nitrates from Air, and Other Discoveries



Tutankhamen's Coffin, World's Finest Work of Ancient Art

HERE are two views of the magnificent gold coffin which actually contained the mummy of the Egyptian boy-king, Tutankhamen. Above, Howard Carter, discoverer of the tomb of the Pharaoh, is seen removing the ceremonial oils which had formed into a gummy, pitch-like substance. At the left is the coffin in all its pristine splendor after having been thoroughly cleansed. This splendid work of the ancient goldsmiths' art was the innermost of three human-shaped coffins which fitted tightly into one another. It is more than six feet in length and is beaten out of about \$250,000 worth of the finest gold bullion. It is wonderfully engraved; its filleted surface of intricate designs is inlaid with turquoise, lapis lazuli, and carnelian. Observe the neatness of design, the perfection of form that reveal the highly developed art of the ancient goldsmiths. The coffin represents the youthful king in the form of Osiris, judge of the dead, holding in his hands the whip and the crook, his body protected by the vulture deities, and his legs by the wings of the Egyptian patron goddesses. It has aroused the admiration of artists as well as the interest of scientists the world over.

POPULAR SCIENCE MONTHLY presents on these pages a symposium of some of the most recent ideas and achievements of scientists that bear especially on our everyday lives.

Our World Fifty Years Hence

WE ALL like to speculate about the world of the future, how we will be living fifty years from now, and how our children will live after we are gone.

If population keeps on increasing in the United States as it has increased in the last fifty years, there will be at the beginning of the next century 255 million people here, according to Professor Howard B. Woolston of the University of Washington. When this condition exists, people may have to be content with tabloid flats like those being built in Vienna. With built-in, disappearing furniture, one piece of which vanishes as another comes into view, a young architect there has just succeeded in putting within forty square yards a hall, a kitchen, a sitting room, and veranda.

A Canadian expert in city planning, Noulan Cauchon, gives us his idea of the

city of the future. He sees city blocks of those days six-cornered instead of square. Hexagonal blocks, he says, will mean more light and air, and the zigzag streets will reduce automobile accidents.

An ingenious idea for heating the houses of the future by radio has been advanced recently by Professor S. E. Dibble of the Carnegie Institute of Technology, Pittsburgh, Pa. He hopes to transmit heat by waves just as sound is sent now. The time may come in our own lifetime, he feels, when heat for an entire city or even a whole state will be broadcast from one great central plant.

Outdoor recreation enthusiasts are advocating that the government plant big forests encircling our great cities. These would provide wood, and also playgrounds for people of the cities.

New Tank Car for Helium Gas

THE United States Bureau of Explosives has recently approved a new type of tank for use on railroads in transferring helium gas, one of the most valuable substances in the world, from one base to another. The new tank has a distinctive cylindrical shape, painted black.

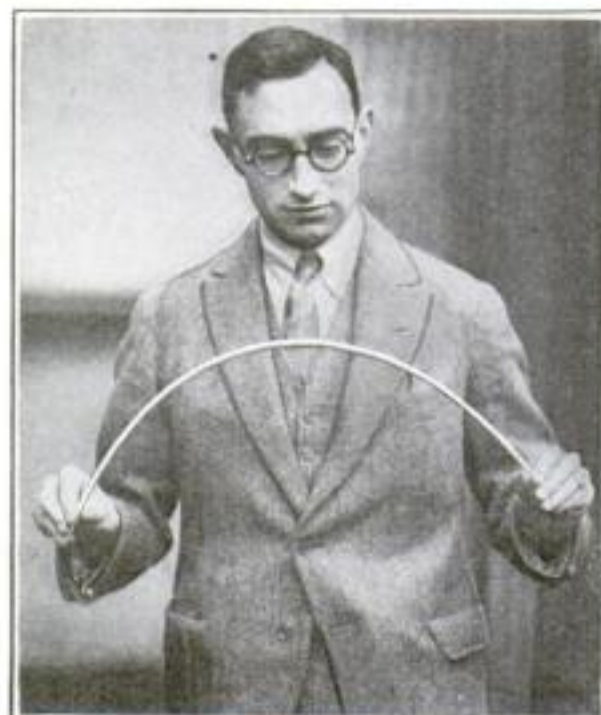
The contents of ten of the cars would be enough, it is said, to fill a dirigible the size of the ill-fated *Shenandoah*. Should we ever have another war, these helium trains would become a common sight. They need careful guarding, for the gas exerts an extremely high pressure, and a heavy shock or jar would cause a terrific explosion.

Chemists Solve War Mystery

DURING the war, the United States seized a German patent on a method of extracting nitrogen from the air. The Muscle Shoals plant was built to make use of it on a huge scale. Nitrogen and hydrogen passing over hot iron prepared in a certain way, the formula said, would give ammonia.

But the process didn't work. Something had been left out of the formula by the German chemists, purposely. The amount of ammonia derived was too small to be worth-while.

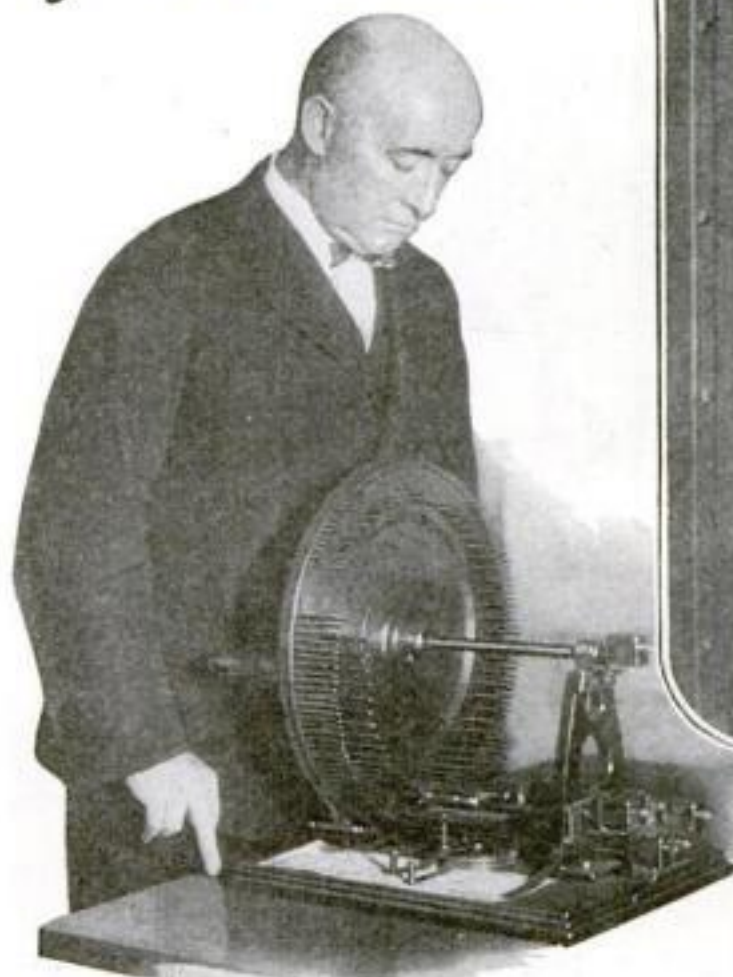
American chemists went to work to discover the missing factor. Now, after years of painstaking research, the Palmer Laboratory of Princeton University announces that if small amounts of alkaline oxides, such as sodium, potassium, and calcium, are added to the iron, the yield of ammonia is increased enough to make the process commercially valuable.



Glass That Can Be Bent

A glass that bends and bounces without breaking is a new Austrian invention. The photo, showing a slender rod being bent, gives an idea of the flexibility of this glass.

of Science



Calculator Forecasts Success

This machine, called a "success calculator," does involved mathematical calculations both quickly and accurately. It was invented by Stuart C. Dodd, of Princeton University. Dr. Howard McClenahan, of Franklin Institute, Philadelphia, shown inspecting it

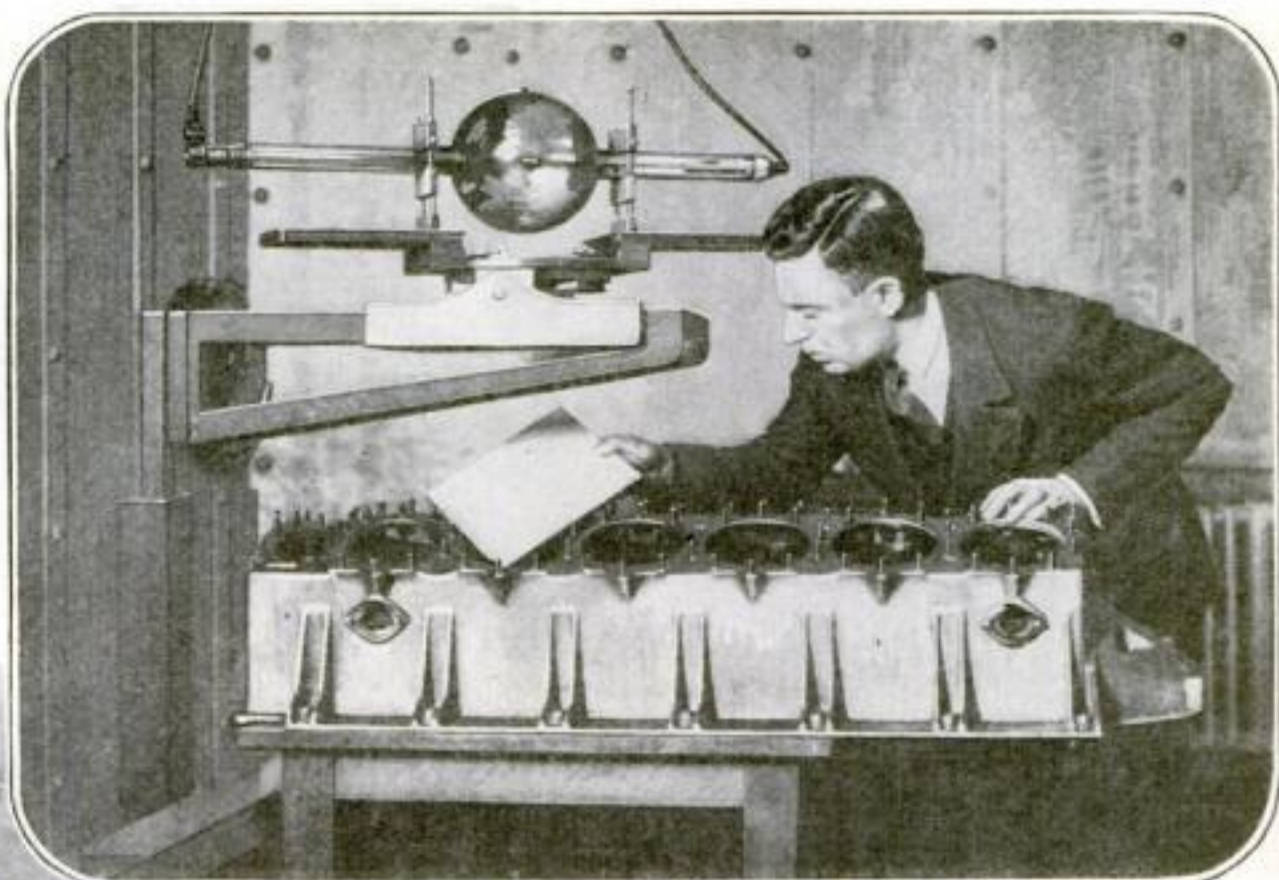
It is a discovery important to every citizen of the United States. It not only will make us independent of the nitrate fields of South America in manufacturing ammunition in time of war, but will lower the cost of foodstuffs. If nitrates can be obtained from the air on a large scale, the farmer will be able to obtain fertilizer at much lower prices than at present.

Leaded Gasoline Safe

TETRAETHYL leaded anti-knock fuel may now be used with perfect safety in your automobile. Consternation created a few months ago, when reports of its poisonous effects caused it to be withdrawn from the market, is allayed by a report of a special committee of the United States Public Health Service which has been investigating the compound and its consequences.

Two hundred and fifty two men were examined, most of them car owners and users and garage employees in Dayton, O., some of them handling gasoline treated with the lead, and some of them untreated gasoline. The conclusions reached were that the anti-knock compound itself is dangerous in concentrated form and must be handled with great caution, but the treated gasoline is safe to handle and use as fuel.

When the lead compound is again put on the market, it will be labeled "motor fuel" instead



Tired Metal Detected by X-Ray to Prevent Accidents

"Fatigue of metals" is the cause of thousands of serious accidents every year. The metal becomes actually tired out from the constant strain, and finally snaps. To detect this strain in time to prevent trouble, X-ray photography is now employed. The picture shows Professor John T. Norton of the Massachusetts Institute of Technology about to photograph through a crankcase to determine if its parts are tired

of gasoline. Clearly distinguished in this way, you will use it only for fuel and not buy the lead-treated gasoline for cleaning, in which case you might run a risk of poisoning by absorbing lead through the skin.

Anti-knock fuel is the result of years of labor of American engineers and chemists. It is good to know that this improved fuel can be used without injury.

Total Eclipse Here in 1932

IF YOU missed seeing the last total eclipse of the sun, in only six years you may have another chance. Last year in January, when the sun's darkening was witnessed by millions of people in the United States, we were told that the path of totality would not fall across our country again for a century. Now, new calculations based on the most recent lunar tables show that an eclipse in 1932 will cross Canada from the northwest and go down through the New England states, passing out to the Atlantic through Massachusetts.

Observations made by the expeditions to Sumatra recently, on the total solar eclipse, on the whole were reported satisfactory. Good photographs were obtained, but it will take months of study before definite results can be announced. The corona, the astronomers report, was the regular round shape, and some very large prominences were said to be visible.

Why Chicks Can Walk

IT TAKES a baby months to learn to walk. But watch a chicken! The minute it pops out of its shell, it struts about, managing its legs without the least effort.

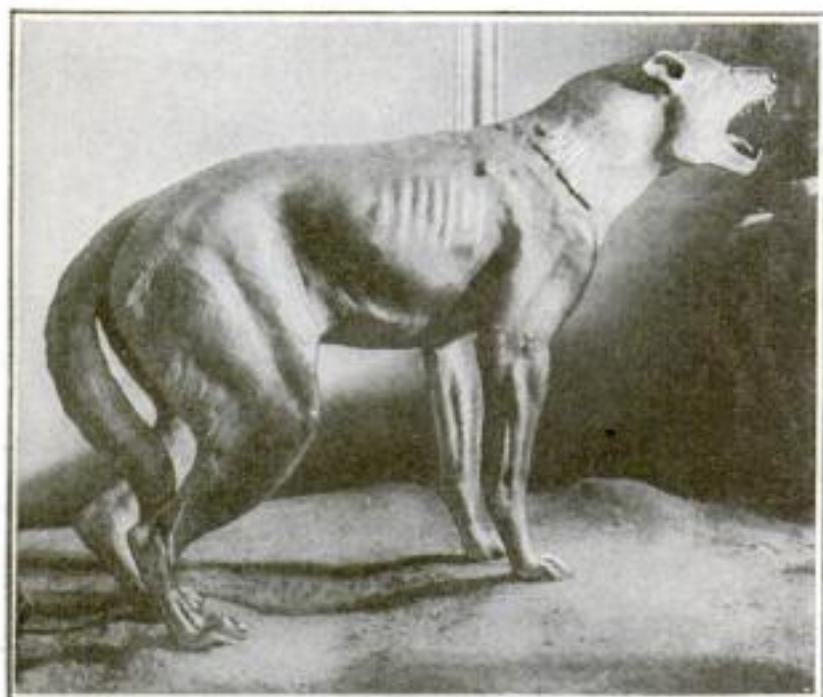
This does not mean that new-born chickens are more intelligent than new-born babies. It merely indicates that balancing and standing are automatic in the chicken and not in the baby. The latter has to use its brain to control its legs. Recent experiments at the University of Chicago show that the chicken's balancing is governed by reflex action, needing no brain at all.



To Study Gorillas in Africa

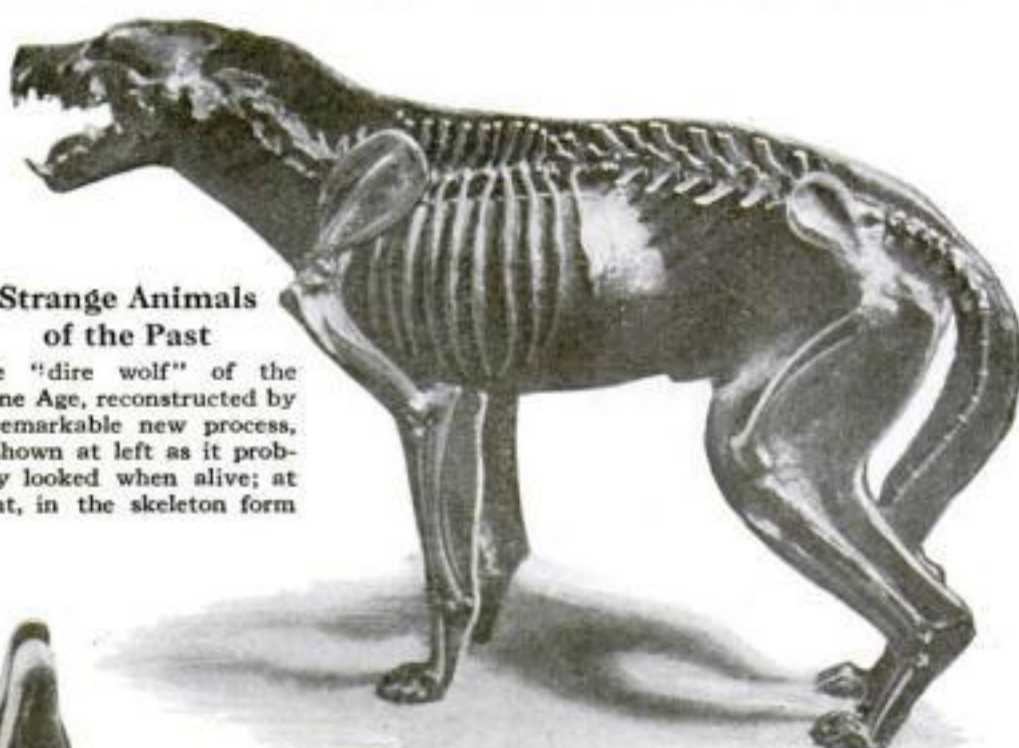
Mr. and Mrs. Carl Akeley, noted explorers, photographed just before they sailed on their latest expedition to Africa to spend eleven months in the study of human characteristics of gorillas

Yale Professor Clothes Ancient Fossils with Life Forms



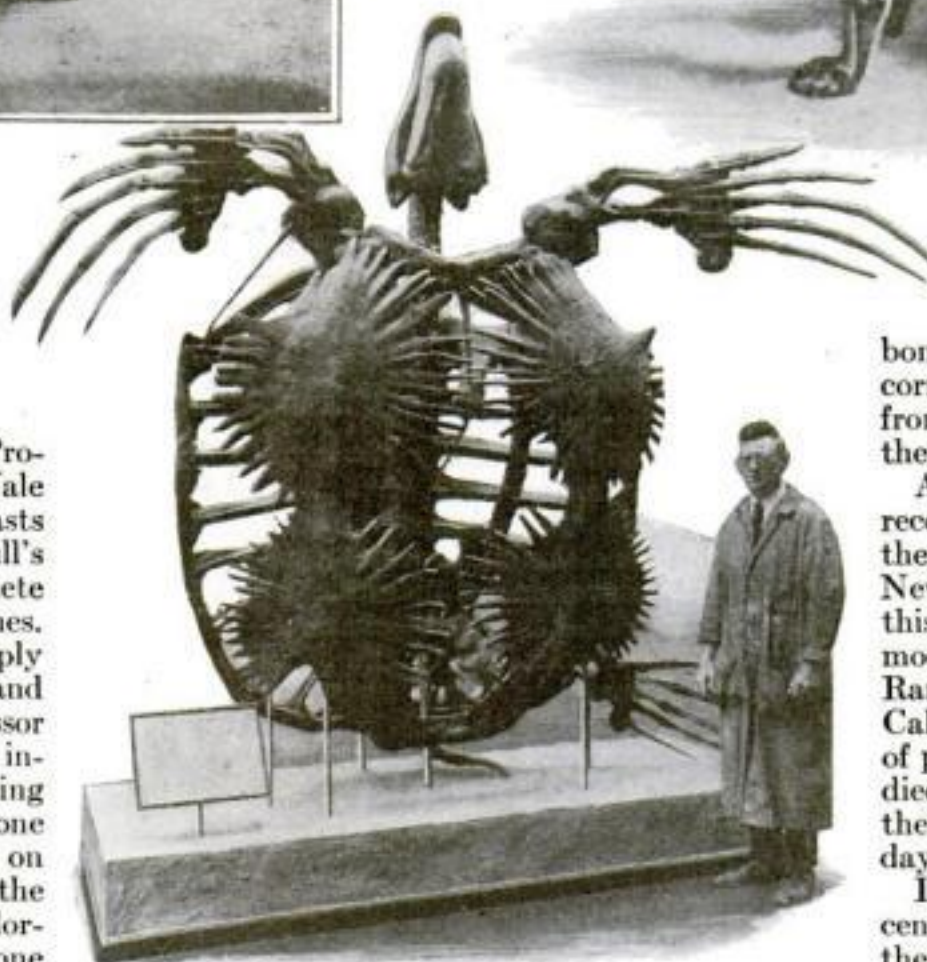
Strange Animals of the Past

The "dire wolf" of the Stone Age, reconstructed by a remarkable new process, is shown at left as it probably looked when alive; at right, in the skeleton form



RECONSTRUCTED skeletons of dinosaurs and other prehistoric animals in museums give an awe-inspiring idea of size, but little else. A new and ingenious method of mounting such skeletons, devised recently by Professor Richard S. Lull of Yale University, shows how the beasts actually looked. Professor Lull's method makes use of incomplete fossil skeletons and defective bones. Hitherto, museums have simply imbedded these in plaster and mounted them on slabs. Professor Lull thought this wasteful, and invented a new way of mounting these bones, that shows on one side the skeleton structure and on the other how scientists think the animal looked in life. Since coloring in animals varies little from one century to another, the skin is painted according to type.

Skill and care are required for



Skeleton of a three and a half ton turtle, the largest known. On exhibition in the Peabody Museum of Yale University

this restoration work. Expert knowledge is needed of the functions of the muscles and bones, in order to build up the flesh correctly. While help may be gained from study of modern animals, yet the skeletons show certain differences.

An interesting example of this novel reconstruction is the "dire wolf" in the Peabody Museum at Yale in New Haven, Conn. The skeleton of this "dire wolf," a giant relative of the modern timber wolf, was found in the Rancho la Brea tar pits, Los Angeles, Calif. In these asphalt pools animals of prehistoric days were engulfed, and died, their bones remaining to tell their fate and give a picture of their day.

In the new Peabody Museum, recently opened to the public, is one of the finest fossil collections in the world. It has been used in an exhibition of evolution in living things from one-celled animals to man himself.

New Powerful Swiss Narcotic Is Entirely Harmless

THE invention of efficient and harmless narcotics for anesthesia and pain-alleviation is one of the most important tasks of modern medicine. Recently, Dr. Maurice Sandoz, of the University of Lausanne, Switzerland, succeeded, it is claimed, in producing a substance termed "tricaine" which is remarkable for its rapid narcotic effects. On cold-blooded creatures, such as fish, frogs or salamanders, two to six minutes in a one tenth percent solution of tricaine induces total insensibility. In this condition, the animal can be examined through the microscope, and the fascinating spectacle of the blood's circulation watched in all its phases.

If the animal is left a few minutes longer in the narcotic solution, it becomes perfectly immovable, apparently lifeless. Wrapped up in moist cotton wool, it can be conveyed from



Dr. Sandoz, of Lausanne University, examining a fish which is under the influence of his new narcotic. Above, the fish wrapped in gauze for handling more conveniently

one place to another. Immersion in ordinary water revives it immediately. The new narcotic is important in biological work in that its use permits the study of animals without vivisection.

A solution of tricaine diluted beyond ten percent exerts no soporific effect. An injection of one cubic centimeter of one percent tricaine solution insures sufficient insensibility to render

minor surgical operations of one to two minutes' duration entirely painless.

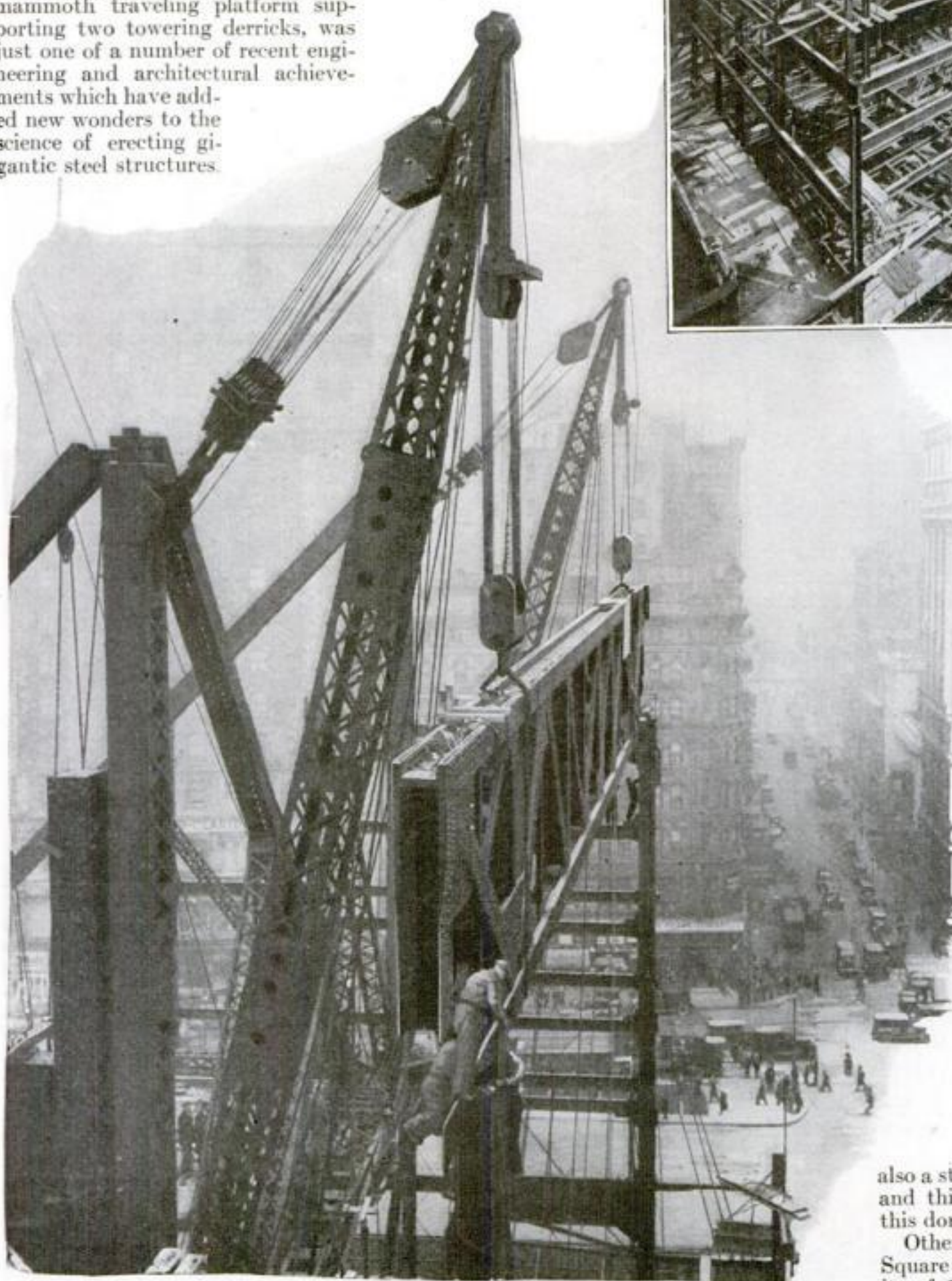
Tricaine, which, unlike cocaine, is said to be entirely harmless, can be administered internally in large doses to alleviate intense pain. It has also been used with success, it is said, in dentistry, a mere external application being sufficient to make the gums so insensitive that, for instance, crowns can be fitted without any pain.

Giant Cranes *in* Record Feats

Huge Girders Test Ingenuity of the Skyscraper Builders

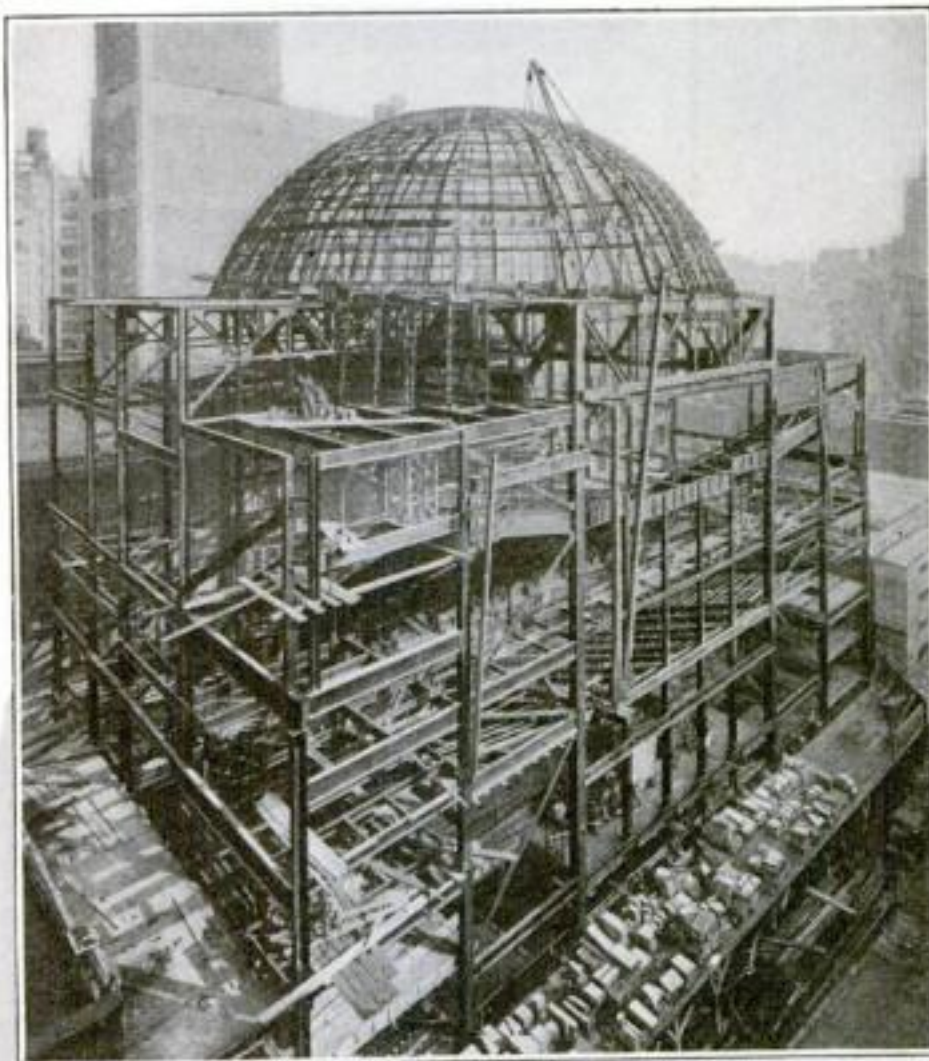
EIGHT stories above New York's busiest thoroughfare a gigantic steel girder, weighing 144 tons, swayed gently in the grip of two enormous mechanical arms. While straining engines snorted, the huge metal beam slowly settled until its ends rested on the tops of two slender steel columns 120 feet tall. There, fitting perfectly to the smallest rivet hole, it was quickly bolted fast. The first of eight massive trusses—probably the largest ever lifted to such a height—thus became a vital part of the steel skeleton for the Paramount building, one of New York City's newest skyscrapers.

This spectacular feat, employing a mammoth traveling platform supporting two towering derricks, was just one of a number of recent engineering and architectural achievements which have added new wonders to the science of erecting gigantic steel structures.



Arms Stronger Than a Thousand Men

Lifting the first of eight 144-ton steel girders into its place 120 feet high on the Paramount building. This is probably the heaviest girder ever lifted to such a height. To accomplish this extraordinary feat, two huge derricks mounted on a traveling platform were used for the work.



A Dome of Steel

An enormous domed roof 108 feet in diameter presented a new problem of steel construction which builders solved successfully in erecting the new Mecca Temple in New York.

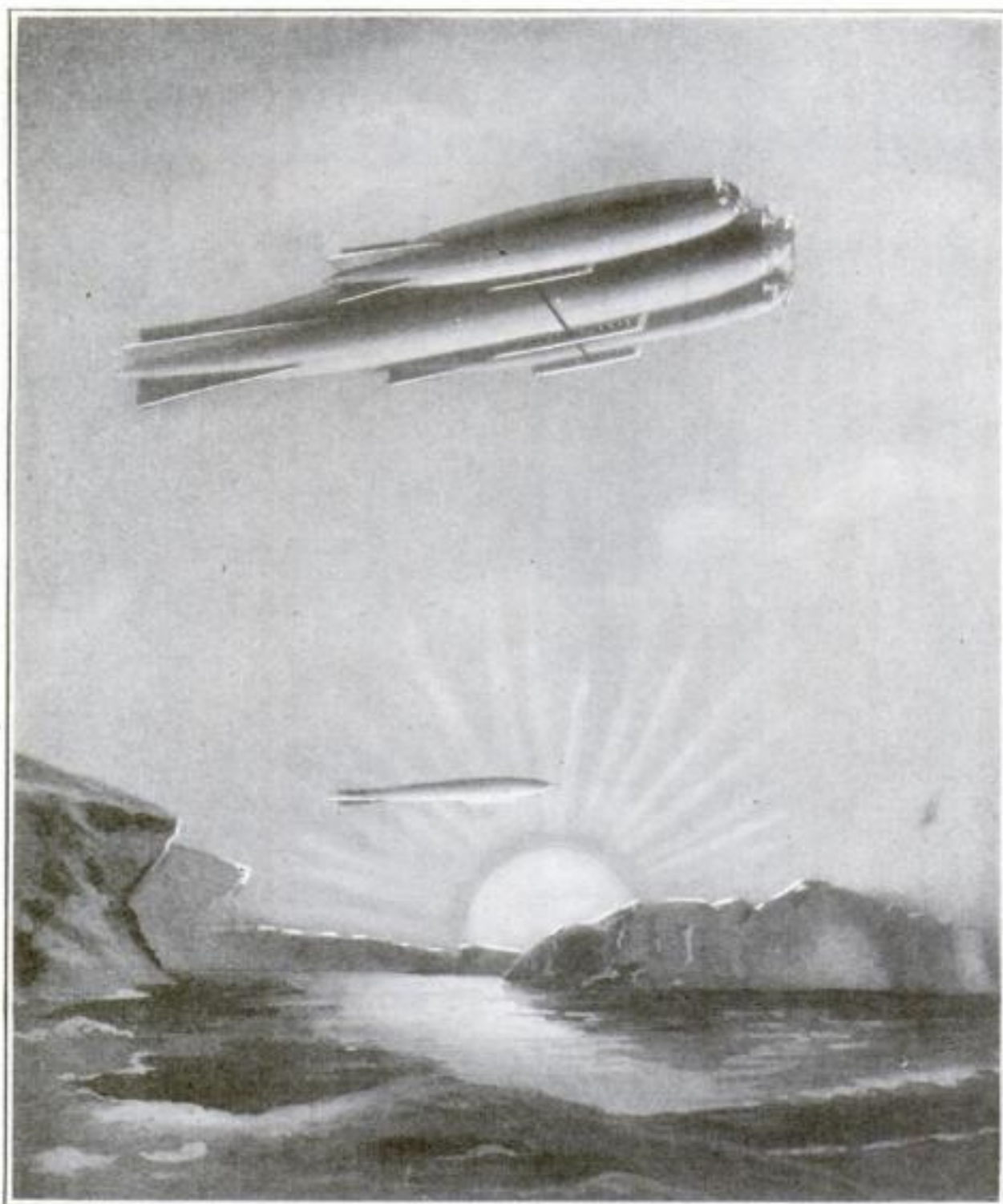
Within the last year, novel departures in design have presented new problems that have taxed the resourcefulness of engineers. In the case of the Paramount building, the auditorium will be without central supporting columns. Beams and trusses must span 120 feet and at the same time support a roof and gallery.

TO MEET this need, the great 144-ton trusses, each sixteen feet high, were constructed. To get an idea of the lifting power of the derricks which hoisted these trusses, consider that it would take 1,000 men, each capable of lifting 300 pounds above his head, to budge one.

An equally difficult problem was presented in the construction of the Mecca Temple in New York City. In it there is a columnless auditorium seating 5,000 persons, and also a steel domed roof 108 feet in diameter and thirty-seven feet high. Supporting this dome are sixteen steel arch ribs.

Other projects include the new Madison Square Garden, with an auditorium capacity of 19,000, and the Level Club, which is to have an auditorium 135 feet wide four stories above the ground, supporting twelve stories above it.

Stormproof Three-in-One Dirigible Invented by German



Flying over the Top of the World Unharmd by Icy Winds

In this picture the artist gives his conception, based on plans, of the new German three-unit dirigible cruising placidly and safely over the frozen stretches near the North Pole

A NEW type of super-airship which is composed of three units, a parent ship and two smaller ships, one at each side, has been designed by Baron Boris von Loutzkov, of Berlin, a noted German aircraft and motor engineer. Its inventor claims that it will be absolutely storm-proof. He bases this claim on its peculiar shape, which he believes will make it less easily buffeted about by the elements. Its shape, he says, will also make it more manageable than a single unit.

This great ship is to be fitted with powerful engines, will be capable of terrific speed, and have an enormous carrying capacity.

Baron von Loutzkov's ship is actually three ships, for each unit is separate and complete in itself, and is joined to the others with steel cables. In case of accident to one or even to two units, the inventor declares, all hands can be transferred to the undamaged part by means of gangplanks that run between the units, and the defective ones can be cut loose. This feature, he says, makes his ship three times as safe and trustworthy as an ordinary dirigible.



A Storm Door from a Screen Door

A NEW use for snaps has been found by a manufacturer who has applied the idea to convert screen doors into storm doors. For the winter, a specially treated covering is snapped on and the result is an excellent storm door. When spring comes, the covering is removed, and the screen door reappears.

In this way the screen door can remain up all year and at all times be protected from the weather. A small window in the storm covering allows the person inside to see who is calling before opening the door. The cover may be attached to any screen door.

VESTUVIUS seldom sends lava flows over the rim of its crater; the hot liquid usually break out on its sides.

Marimba *Vibrato* Produced by Electric Fans

SOMETHING new for the busiest man in the orchestra—the drummer—is a steel marimba with an electrically operated *vibrato*. The instrument, just produced by a manufacturer of drums and percussion instruments, is being introduced in the modern orchestra and on radio programs. It is said to be easy to master, and its *vibrato* makes it unnecessary to roll with the hammers. Chords, arpeggios and octaves create beautiful effects, and the tone produced compares with the pipe organ, it is claimed. It has great volume and carrying power.

The *vibrato* of the steel bars is produced by electrically controlled rotating fans, one in each resonator. The speed control lever on the motor enables the performer to set the *vibrato* to suit the character of the number played—producing a true *vox humana* effect in the steel marimba.

The new instrument is especially designed for use in accompaniments or obbligatos in songs and modern lyric music.



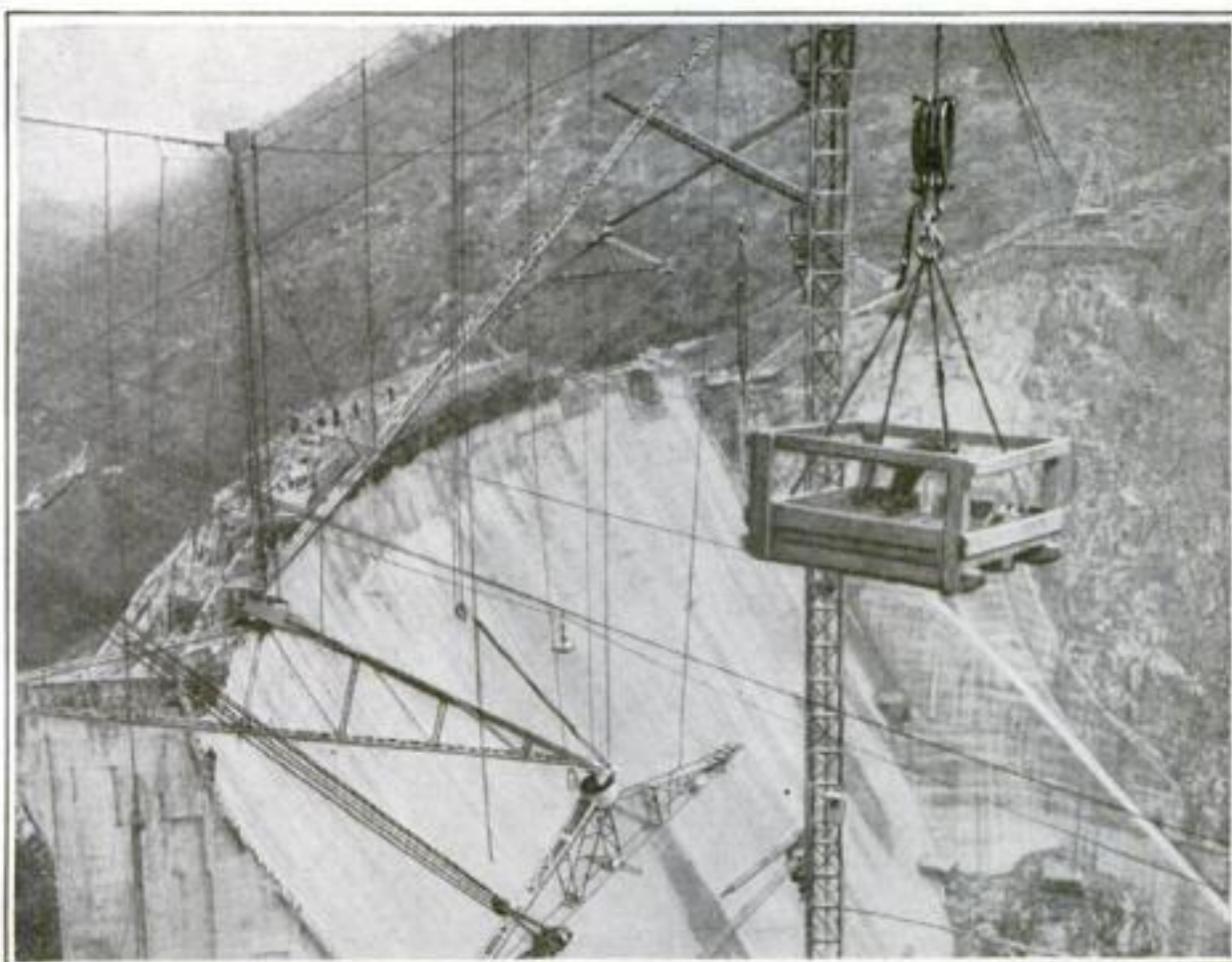
George W. Marsh, drummer of Paul Whiteman's orchestra, playing the new type of marimba which makes it unnecessary for the performer to roll with hammers to produce a singing tone

Huge Dam to Form Mountain Lake for Water and Power

GREAT tracts of land in California have hitherto been unworked because water has been lacking. This handicap of nature is being overcome, however, by irrigation from great water basins in the nearby mountains.

The picture at the right shows the gigantic dam of one of these now being erected in the High Sierra mountains of California. It is called the Great Exchequer dam. When completed it will measure 950 feet in length and 326 feet in height, and will form a lake twelve miles long. Three hundred and eighty thousand cubic feet of concrete will go into this gigantic barrier.

The water stored in this lofty reservoir will be used not only for irrigation purposes, but also to provide the territory it serves with electric power and light. Water and electricity entering the new farm lands at the same time will open a new chapter in the history of reclamation.



New Oars Let Rower Face Bow

TO KEEP a rowboat headed for a certain point as one rows with one's back to the bow, requires skill and constant turning of the head.

The newly invented reversible oars, shown in the picture above, enable a rower to face the bow and row ahead as if his back were to it, or to face the stern as with ordinary oars, it is claimed. The oars will fit in any standard oarlocks, or the device that makes them reversible may be attached to ordinary oars.

A Painless Tooth Drill

THE nerve-racking, painful drill that the dentist uses to bore into a throbbing tooth will cause patients no further worry when a new type of drill recently invented in Germany comes into general use, it is asserted. The new instrument has a cocaine needle combined with a drill. The cocaine, under pressure from the dentist's finger, flows into the hole,



deadening the pain as the dentist drills in. The new drill has received many tests, all said to have been successful.

My ONLY objection is that POPULAR SCIENCE MONTHLY isn't a weekly.—O. E. G., Durham, N. C.

DIRTY-FACED stone buildings now can be steam cleaned so that they look almost as good as new. In a series of tests recently conducted by the United States Bureau of Standards, live steam cleaning was first tried successfully on dirty stones in the laboratory, and then on a twenty-year-old accumulation of dirt on an old bank building in Baltimore.

How Much Do YOU Know About Science?

HOW many of the following questions can you answer? Here is a real test of what you actually know about the phenomena of nature you are witnessing every day. None of the questions is hard, and all concern things you ought to know. Try off-hand to answer them, and then turn to page 143 for the correct answers to see how near right you were.

1. Why does fast music make you feel more active?
2. How did ancient surgeons produce anaesthesia for operations?
3. What is distilled water?
4. How do we know that the sun rotates on its axis?
5. Does the sun affect the tides?
6. Why can you beat up white of egg into a froth though you cannot do this with water?
7. What makes the undertow at the sea beach?
8. How does a caterpillar turn into a butterfly?
9. How do bacteria assist in the manufacture of linen?
10. Why does salt make us thirsty?

This Machine Cuts and Loads Corn Stalks



New tractor clearing field of shocked corn

IN THIS mechanical age practically all the work in the fields can be done from the seat of a tractor or other motor-driven machine.

The photograph at the left shows one of the latest additions to the farmer's machinery, a remarkable motor contrivance that goes through a field of shocked corn, cutting the stalks into pieces for feed, and also loading them on the wagon.

The Curious

Unusual People, Odd Sights,



The Tippiest Grand Stand

The oddest way yet devised for "seeing New York" is to balance yourself on two legs of a chair atop a skyscraper. Johnny Reynolds, noted daredevil, recently did that very thing on this dizzy roof, proving himself to be a decidedly well-balanced gentleman.



A Hard-Wear Dress

Miss Mary Tidwell of Tampa, Fla., has set the most unusual fashion. She wears a dress of screen wire fringed with bottle brushes. Skirt decorations are pot racks, while locket and necklace are a padlock and dog chain. The hat is a strainer, trimmed to mode.



Where Old Cars End

One of the strangest things about the nineteen-odd million automobiles in the United States is where they all go when worn out. One answer is found in the remarkable picture at the left. This huge "bone heap" of old cars was photographed at Salt Lake City, Utah. The metal is salvaged, and the rest goes up in smoke.



They're All Birds

The island of San Martin, off southern Peru, has the most extraordinary population on earth. It consists chiefly of Guanayes birds—hundreds of thousands of them. Man and animal have hardly elbow room, as you can see.

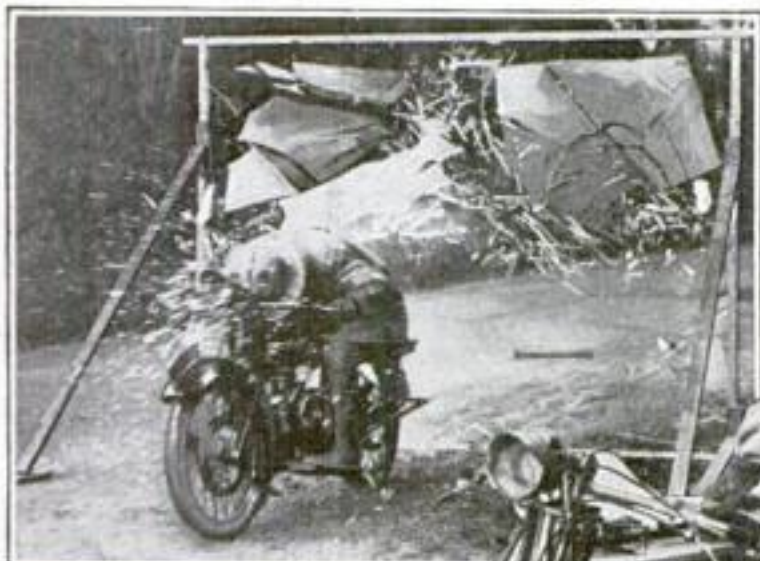


Dog Locomotives

The only railroad operated entirely by dog power runs northward from Nome for ninety miles. It is known as the Dogmobile Road. Eight dogs can haul a quarter of a ton of freight from forty to fifty miles a day, and seemingly enjoy it.

Side of Things

and Out-of-the-Way Places



Crash!

Anyone can dive through a plate glass window—if he wishes. But how many could make the plunge at sixty miles an hour and come through with only two small scratches? Such is the remarkable feat of Harry Lorraine, English daredevil motorcyclist. The upper picture has him at the moment he crashed through the glass obstacle

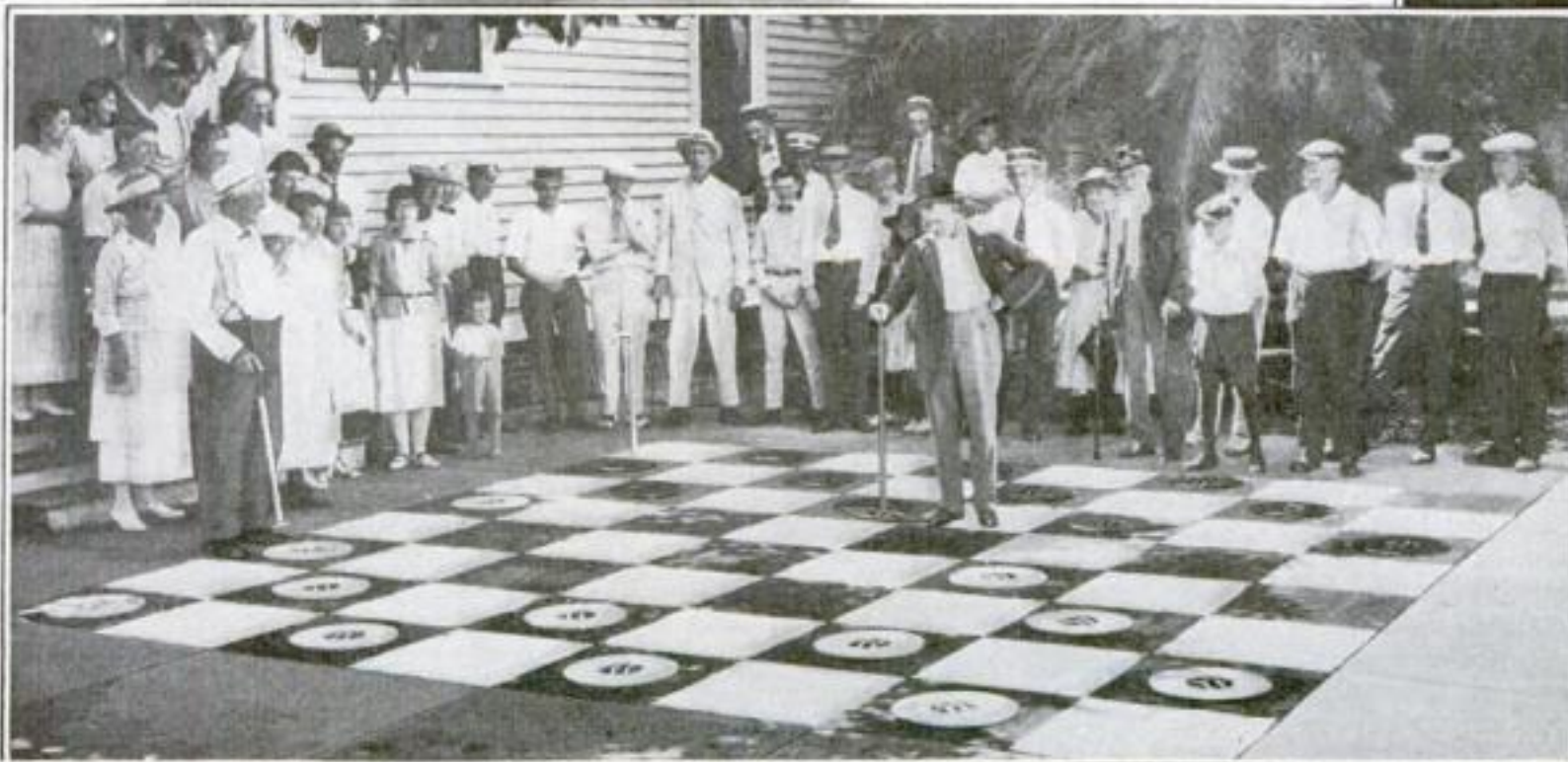


After the crash—the glass smasher and his motorcycle. Notice that his only head protection was the felt hat shown



"Here Comes School"

That's what children of Oakland, Calif., say as they see a strange schoolhouse on wheels towed down the street by a motor truck and anchored on a vacant lot



World's Largest Checkerboard

Now the time-honored game of checkers assumes its place with golf as a mild form of exercise in Clearwater, Fla., where the huge squared "board" shown at the left has been laid out in black and white cement on the pavement. Here old-timers match their wits, playing championship matches with large flat disks which they push about with rods. Whose move is it?



They Roll through Life in a Barrel

Never was there a stranger home, nor one quite so upsetting, as that of the brothers Feldgren, who are rolling their way around Germany in a barrel to pay a bet. This picture shows them making their morning toilet in Berlin, where the police arrested them, then let them roll away in their unique car



Living Fireworks

An unusual Fourth of July novelty promised for this year is animated fireworks. Spectators will see human figures, illumined in fire, stage boxing matches and perform other antics. The actors wear asbestos suits (left) filled with fireworks, producing the spectacular effect below



"Cold Light" Obtained with Liquid Lens



The inventors of the "liquid lens," holding and gazing into a powerful light made "cold," and consequently safe, by their device

LIGHT without heat, or "cold light," is obtained with a "liquid lens," by three Massachusetts inventors. Light that unfiltered would burn the skin or ruin the eyesight, now can be approached without injury, it is claimed.

Various liquids are used for the lens, but the commonest is copper sulphate glycerine. It has been adapted to ultra-violet ray treatments and motion-picture apparatus.



Lock Has 1024 Combinations

THIS new lock has no key, but is said to fasten more securely than one with a key. That means the owner, who knows the combination, need have no worry about his key. As long as he remembers the combination, which he has chosen himself, he can open the lock.

The combination is controlled by a series of ten rings contained within the padlock and capable of 1024 combinations, of which the owner may take his choice. The combination may be changed at any time. Since it is worked by touch, the lock after a little practice may be opened quickly in the dark.

Women Skilful at Electrical Work

DEFT fingers that handle delicate objects with skill and speed have helped women to get unusual jobs in many electrical manufacturing plants. In the Western Electric Company, scores of women are employed in making, inspecting, and assembling parts.

Some make the diamond-dies used in drawing the finer sizes of wire. Others attach the filaments in tiny lamps used on telephone switchboards. These filaments are about one sixteenth the diameter of a human hair, and the work on them has to be done under microscopes. Splitting sheets of mica to .0008 of an inch thick, or flimsier than the thinnest gold leaf, is another job that has been entrusted to the light touch of women's fingers. Women are also employed to wind coils and operate presses.

At the right, a girl expert is shown assembling cables on a local switchboard.



Her light fingers make it possible for this girl to assemble switchboard cables

Tailors' Dummies Move Heads

DUMMIES that move their heads, lips, and eyes by means of electric motors concealed within them, have been devised by Paris tailors to make their models lifelike.

The faces of the dummies are made of a new substance called staff. This is a mixture of fiber and plaster that is said to be far less brittle than the usual wax and to make possible more natural coloring.

Discarded Grindstones Make Fine Walls

A NEW use for old, worn-out grindstones has been discovered by a large Philadelphia hardware manufacturing concern. They make excellent walls, either in their original shape or cut into blocks. Broken up, they are excellent for road-beds.

A wall several blocks long, around two sides of the 65-acre tract occupied by this factory, is built of these stones. A third side, along the Delaware river, has a massive retaining wall also of grindstones. Still more grindstones were used to build a large church nearby.

More than 2,500 of the grindstones were used in building the church, while many thousands went into the wall

around the plant and the retaining wall on the river front.

In the retaining wall, the stones were used just as they were discarded from the factory, but for the wall around the plant and for the church the stones were carefully squared. No one looking at church or wall ever would imagine that they were built of grindstones.

Old grindstones also have been used as the foundation for roads about the factory.

Door Knob Turned by Foot



Chain Turns the Knob

IF YOU have ever tried to open a door while your arms or hands were full, you will look with favor on a new invention that enables one to open a door without grasping the knob. Stepping on a foot trip automatically turns the knob, and a slight push opens the door.

The device, which fits on any door, consists of a chain attached

from the door knob to a small foot trip fastened on the bottom of the door. When this trip is pressed down with the foot, the chain turns the door knob.

The new device, in making the opening of the door easier, will also put an end to kicking and denting the bottom of the door to call someone inside.



Looking at the wall above, one would never suspect it is made of grindstones cut up into blocks as shown at the left

Work While You Telephone

HOLDING the receiver close to the ear while using the telephone is often tiresome, and at times a nuisance. A new telephone device, known as the audiophone, eliminates the necessity of holding the receiver during telephone conversations, and leaves both hands entirely free.

Besides this, the new instrument amplifies the voice of the speaker at the other end of the line, thus helping to relieve the strain of listening, and also allowing a third party to listen in on a conversation, if it is so desired.

Its greatest benefit, perhaps, is that it allows a person to keep on with his work while he is holding the wire for his connection. A great amount of time can thus be saved in business hours.

The audiophone is attached to the inverted receiver, and requires no change in the telephone. The receiver hook is controlled by a lever, which is clamped around the post and raises the hook and receiver for an incoming or outgoing call.



Your telephone receiver stays on the hook while the telephone is in use with this new device



A Swing That Children Can Push Themselves

A NEW push-yourself swing is delighting small children who want to swing when there aren't any grown-ups or other children around to give them a boost. Children as young as two and one half years can use it. It has a seat like a kiddie car, a handlebar, and a rest for the feet. Pushing alternately with the feet and hands makes it go.

The swing may be attached on the porch or indoors in attic or basement, wherever the ropes can be fastened independently. For the lawn, the frame shown in the photograph above is used.

SELF-STARTING foghorns that begin to blow whenever a thick mist gathers have been invented in France. The device is set in motion by the action of the damp air on calcium carbide. It has been successfully tested, it is said, in several French ports where fogs are frequent.



Measures High Temperatures

A THERMOMETER recording 1800 degrees, or nearly twice as many as can be registered on any mercury thermometer, has been devised. The tube is of clear fused quartz and is filled with gallium, a rare metal with high boiling point which has never before had any practical application.

Thermo-couples, up to the present, had to be used to measure temperatures higher than those recorded by mercury thermometers, but it took an engineer or a chemist to operate these. The new instrument, developed by the research laboratory of the General Electric Company, can be used by anyone. It is shown at the left.

A RECORD for comets discovered was made in 1925, during which eleven were noted by astronomers in various parts of the world. Some were hitherto unknown, while others were historic visitors returning for their periodic appearances. The nearest approach to this record in recent years was in 1921, when seven were found.

Grass Catcher Fills Evenly

TO GIVE the cutting effect of a scissors, the revolving knives of lawnmowers are set at an angle of about 20° with the fixed blade. This results in the cuttings all being thrown to one side or the other of the grass catcher, instead of being evenly distributed.

The grass catcher illustrated here is pitched at an angle, and lies directly in the path of the falling grass. None is spilled, and the catcher is filled uniformly. A partition inclined toward the front keeps grass from pushing out again after it is once caught.



Free Shade Provided for Automobilists

AUTOMOBILE gasoline and service stations have been giving free air these many years. But now comes a considerate gas station proprietor who is providing free shade for tired, sweltering motorists. Out in the West, where trees

are few and far between, this service is sure to be appreciated.

The shed, with its sign of invitation, shown in the picture below, was erected in Bradley, Calif., and is giving relief daily to hundreds of grateful, jaded patrons.



This "free shade" station offers welcome relief to motorists on sun-baked roads

Interesting People;

America's Youngest Pilot

THE youngest licensed air pilot in the United States is said to be Farman Parker, fourteen years old, of Anderson, Ind., who recently passed the necessary tests with distinction. He has been flying for many years with his father, who is a pioneer aviator, and had no difficulty in obtaining a license.

Farman was born in St. Paul, Minn., but has lived most of his life in Indiana. The picture at the right shows the young aviator standing in front of the plane that he uses in making his flights.



AN ELEPHANT'S tusk filled with gold was discovered recently by a group of explorers in Alaska. During the centuries the tusk became buried and fossilized and gold nuggets were imbedded in the ivory. The tusk weighed 250 lbs.

He stands seven feet four in his stockings

Young Giant Engineer Runs Miniature Train

THE interesting photograph above shows the youngest and tallest locomotive engineer, Jack Farl, of Venice, Calif., and the smallest engine on the Pacific coast. Jack and the engine which he runs are among the principal attractions of Venice. The contrast, as seen in the picture, is amusing.

Jack, who is only fifteen years old, stands seven feet four inches in his stocking feet and weighs 237 pounds. He is still growing. The longest overalls he could find were more than a foot too short, so he had to have pieces added to the bottoms of the legs. If you look closely at the picture you can see the seam in them.



"Red" Smith turning a bat handle

Old Baseball Star Makes His Own Bats

LAST year "Red" (J. Carlisle) Smith, former National League baseball star, led the Southern League in batting. This year he hopes to repeat with bats of his own making. In the picture at the left he is turning a bat handle on a lathe under the guidance of C. M. Hughes, a noted bat maker of the South, at Atlanta, Ga.

"Red" was the star third baseman of the sensational Boston Braves in 1914 when they walked off with the World's Series four games straight. He has been out of the major leagues for some years, but is still going strong in the minors.

Fine Violins Made in Home Workshops

LARGE factories turn out every year thousands of violins made of the finest woods, thoroughly seasoned, exact replicas of the old masterpieces in every detail. Yet for all the care in their manufacture, they fail to approach in quality the fine old instruments of Stradivarius, Amati, Guarnerius, and the other great masters of the Cremona school.

When the old masters died, the secrets for the production of these wonderful violins died with them, but certain of the traditions of fine violin making have lived on and still flourish at Mirecourt, France, which is now the violin center of the world.

The Mirecourt violins, which are the nearest rivals of the old master instruments, are made not in large factories but in home workshops such

as the one seen in the picture below.

There all the parts are fashioned and put together by hand with all the patience and care of the old masters.



Making violins in a home workshop at Mirecourt, France

Grafts New Eyes on Animals

AFTER several years' experiments, Professor E. Guyenot of the University of Geneva has succeeded in creating sight in animals and hopes soon to extend his work to human beings. He chose tritons as the subjects of his important experiments.

The optic nerves of the tritons were cut and the eyes extracted. Then, after a certain period, he grafted new eyes in the orbits of the original ones. In eighty-four cases he has worked on during the past eleven months, only three have been complete successes, but these three prove conclusively, he claims, that he is on the right track.

Grafting eyes on inferior vertebrates, he says, is not more difficult than grafting heads, tails or legs on them, since it is possible to renew a connection with the brain.

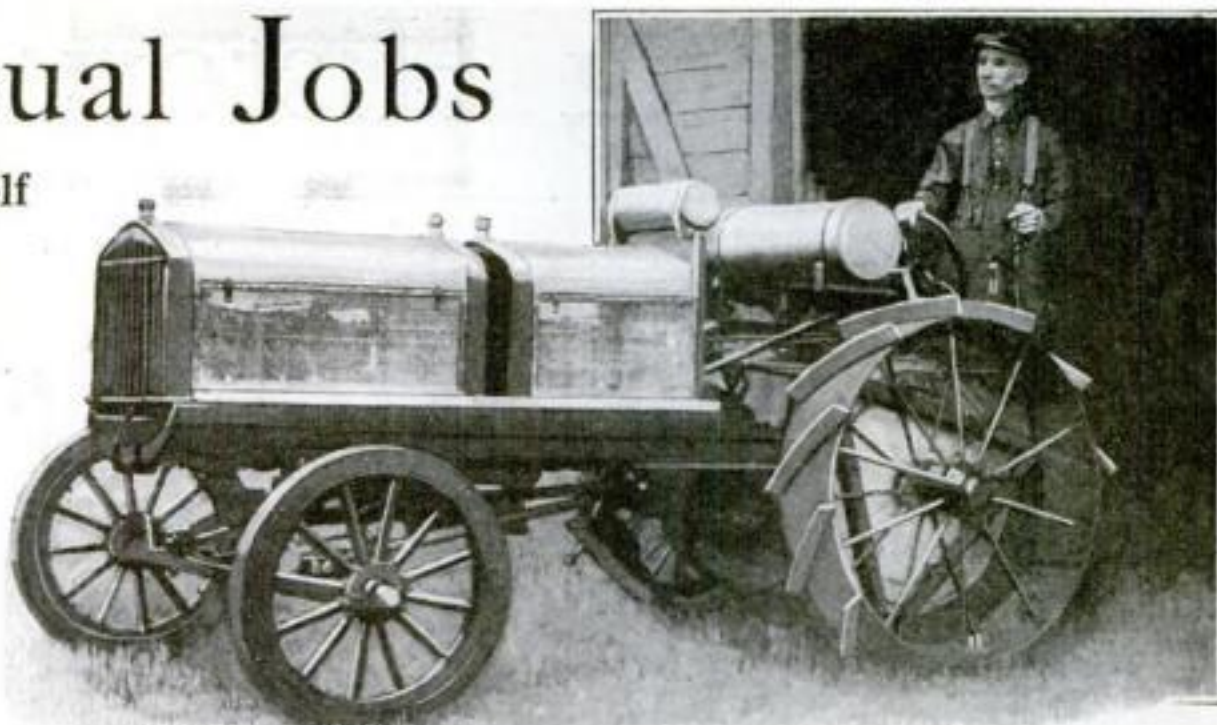
Their Unusual Jobs

He Made This Tractor Himself

A **HOMEMADE** tractor of novel construction is the proud possession of G. F. Erikson, a pumping station engineer of Bowdle, S. Dak. With the exception of the engine and the transmission, it is entirely his own work.

The power for the tractor is furnished by two Model T Ford engines which he has connected tandem fashion, so that the single crankshaft receives two impulses on each revolution. The wheels, frame, drive pinion, ring gear, and all the other parts of the tractor Erikson made himself in his home workshop, where he works evenings, when his day's work at the pumping station is over.

In the picture at the right, Erikson is seen proudly driving his odd-looking but efficient tractor out of the shed.



Noted Potter Fires Kiln Only Once a Year

WHAT Wedgwood is to chinaware, that Delaherche is to pottery, the finest of its kind. The French pottery is remarkable for its wonderful glaze, its perfect shape, and its exquisite coloring. Comparatively rare, it is much sought after by collectors, and is accordingly high priced.

While many know and admire this pottery, few know anything of its maker and its manufacture. It is made by Auguste Delaherche, an old Frenchman who lives at Armentières near the town of Beauvais, famous for its tapestries. All his pottery is made from clay that he digs in his own garden. And he has ideas of his own about his work.

Throughout the year he makes a considerable number of objects, each unique in its way, but he fires only once a year. At this time he stands by the kiln for thirty hours without sleep, to be sure of an even heat. Even heat, he says, is the secret of the wonderful glaze that makes his work stand out from all others.

Delaherche is shown in the picture at the right sitting in front of his kiln. Because of his high proficiency, he has been called the Della Robbia of the century,

and the master potter of the world. But he is something of a philosopher, too, and many visitors seek him out to listen to his shrewd remarks, based upon years of observation and sound thinking.



Capitol Gavel Maker Busy When Congress Meets

FOR twenty years, J. C. Pakin has been official gavel maker of the Capitol at Washington. During that period he has made all the wooden mallets used by the presiding officers of the Senate and the House of Representatives.

Although the gavels are made of the most durable wood obtainable, in the excitement of debate they frequently are broken in the speaker's endeavors to restore order, and the gavel maker is usually pretty busy keeping a sufficient reserve supply on hand. In the photograph Pakin is shown working on a new gavel head, which he is turning on his lathe.



J. C. Pakin making a speaker's gavel

Music Lesson atop a Bridge

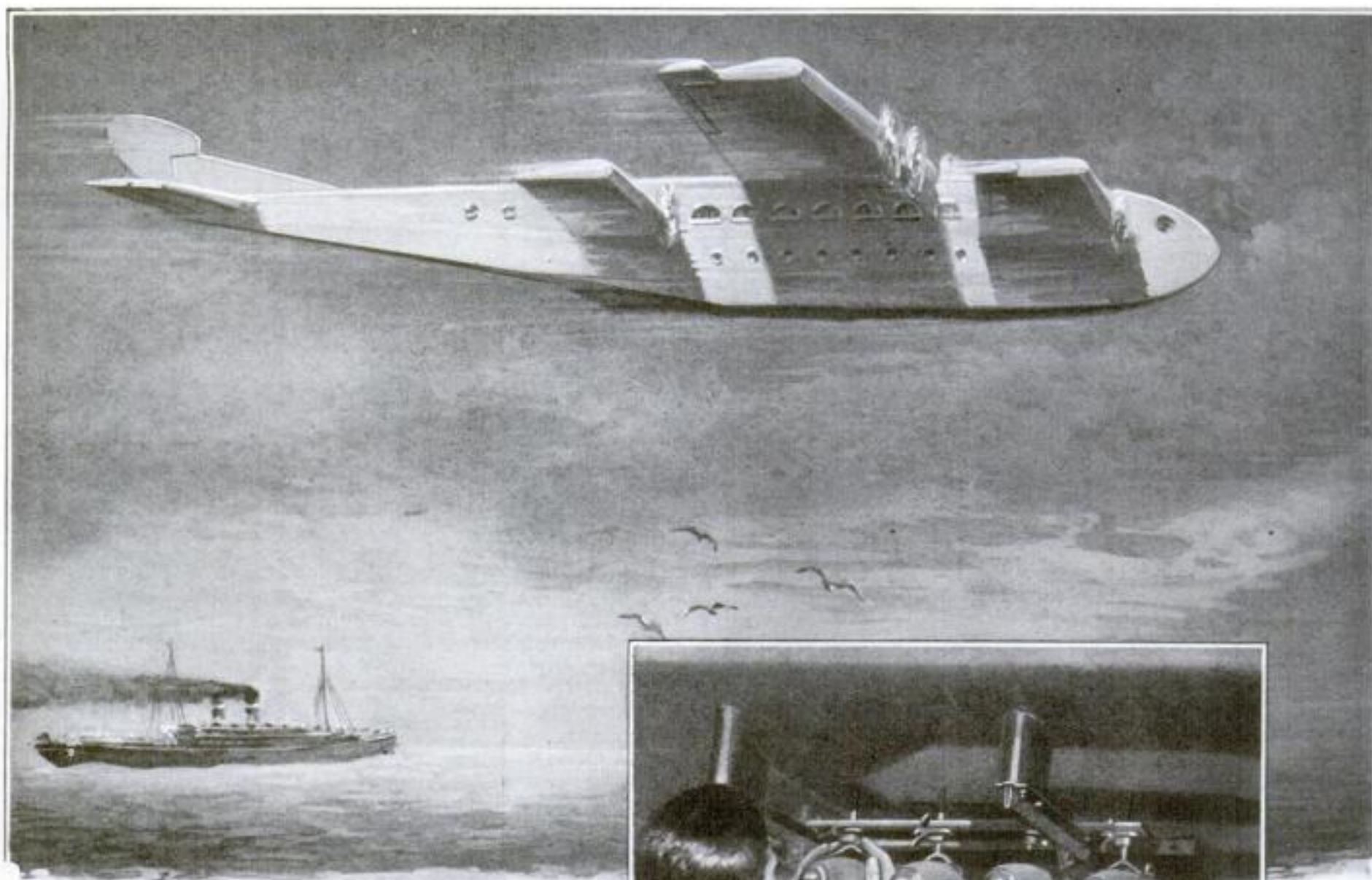
TAKING chances is not confined to any one class of workers. The picture above shows Ross Gorman, a New York saxophone teacher, giving at the risk of his life a lesson to August Sarentino, a painter, high up on Brooklyn Bridge, New York City, where Sarentino is working.

Perched high on the swaying cables, Sarentino runs his scales while the teacher holds music for him. The lessons are given during the pupil's lunch hour, and to save time the teacher climbs up the rigging to the place where Sarentino is painting.

Apartment house dwellers who have to suffer from beginners' efforts on musical instruments will approve heartily of the idea. If one must learn to play a saxophone, it is hard to imagine a better place to practice, say they, than on a high bridge.

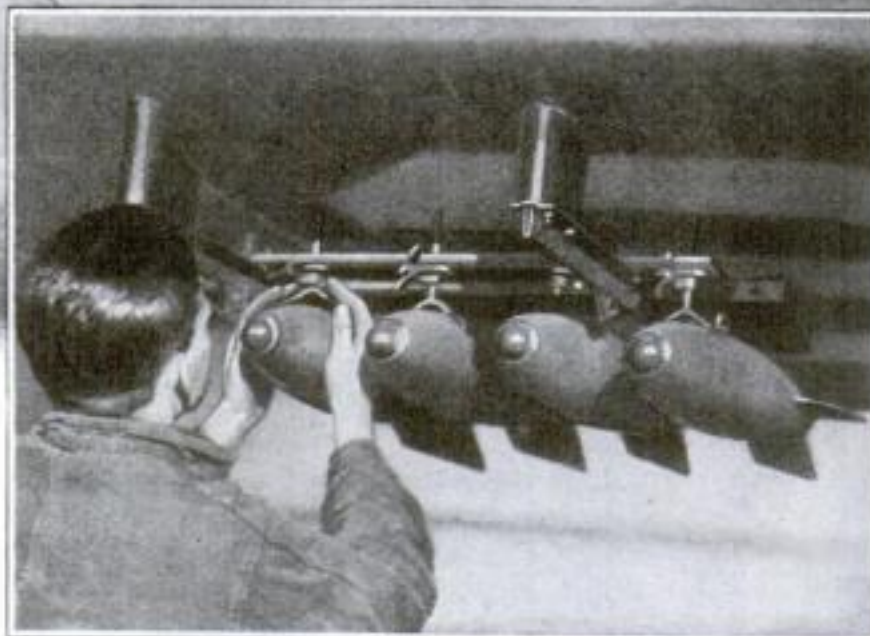


Making History in the Art

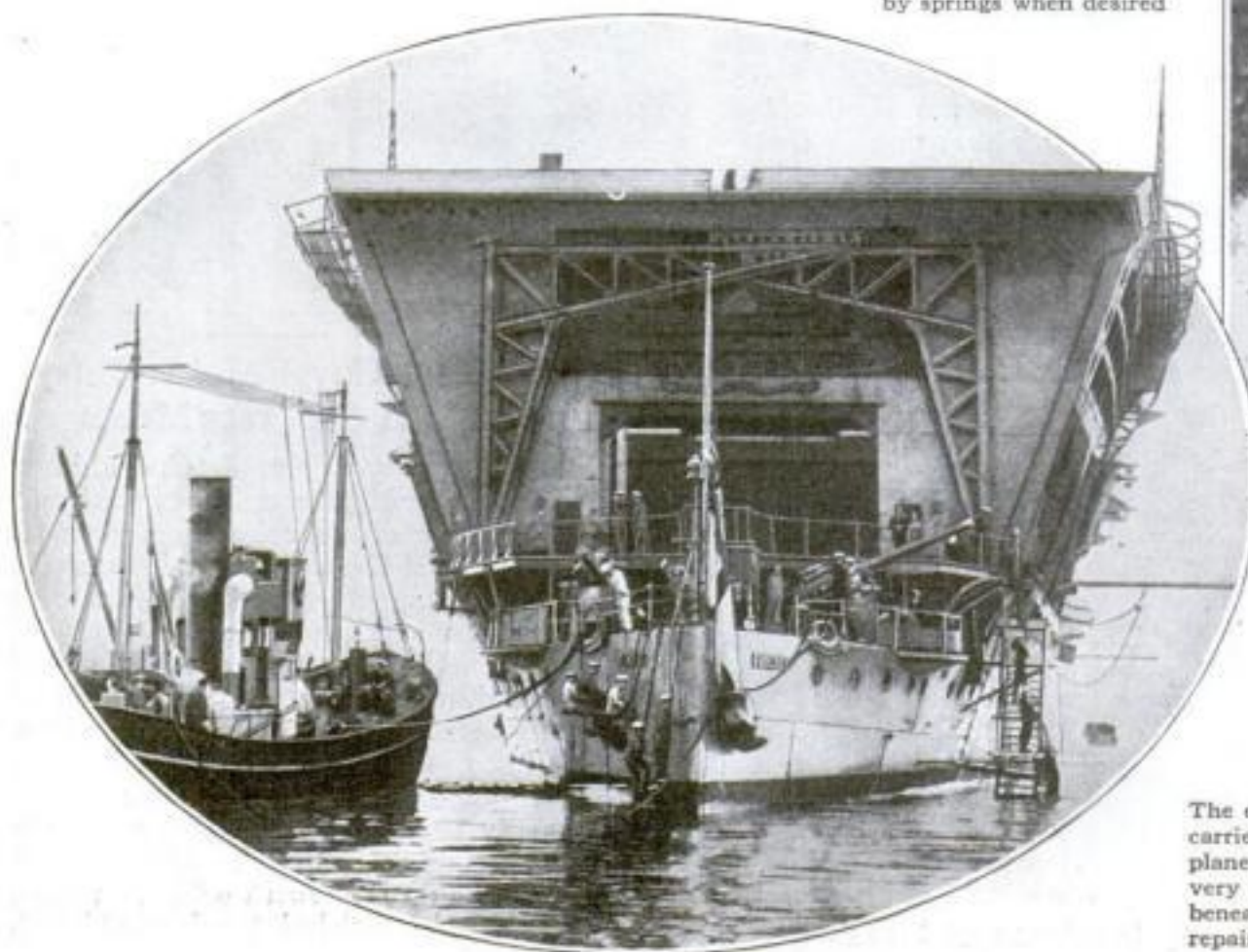


To London in 18 Hours in New Plane

Above is an artist's conception of a great passenger and freight airplane whizzing past an ocean liner as it speeds across the ocean. Yet it is not a mere product of the artist's imagination. It is inspired by plans for a monster monoplaner, capable, it is claimed, of flying from New York to London in eighteen hours, designed by Dr. Armin de Muth, a German inventor. Models of the plane have been tested by Professor Edward P. Warner of the Massachusetts Institute of Technology. Dr. de Muth's plane, which is soon to be constructed, will be all metal and unsinkable. Its length will be 147 feet, and it will have a carrying capacity of fifty passengers and two tons of freight.



The small bombs, above, are carried under the planes and are released by springs when desired.



Army Tests Its Bombers

At the recent target practice at Mather Field, Calif., army bombing planes made some marvelously accurate shots from very great heights. Perfect hits, such as the one shown above, were made with surprising frequency.

Ship a Complete Flying Field

The queer-looking ship at the left is the giant aircraft carrier, H. M. S. *Furious*, mother ship of the scout planes of the British Atlantic fleet. It has a high and very wide deck that forms a large flying field, and beneath this are hangars where planes are stored and repaired. The vessel has a crew of 890 officers and men.

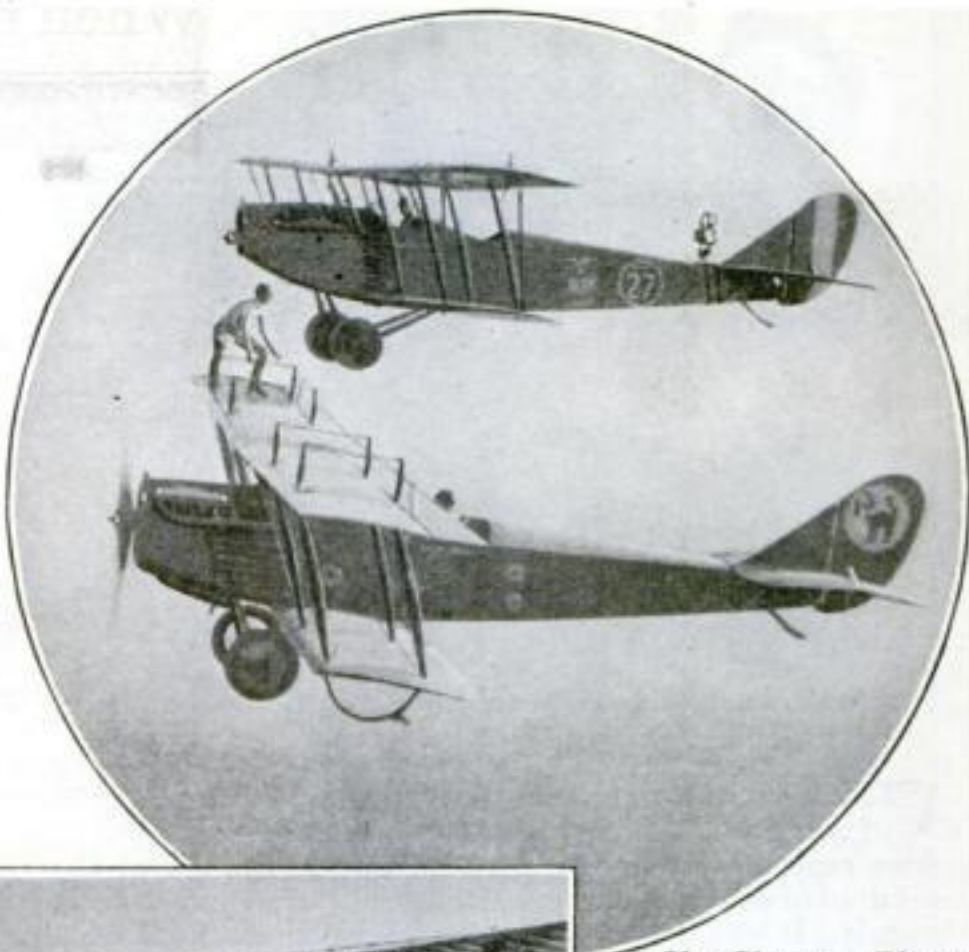
of Aeronautics



Lester P. Barlow, of Connecticut, with the two types of bombs he has invented

Novel Air Bombs of Huge Size

A new torpedo for bombing planes, said to have a capacity of two tons of explosives and a range of 1,000 miles, has been invented by Lester P. Barlow of Stamford, Conn., who specializes in air bombs. He has offered Congress a torpedo in which gas for the carrier plane may be stored with safety



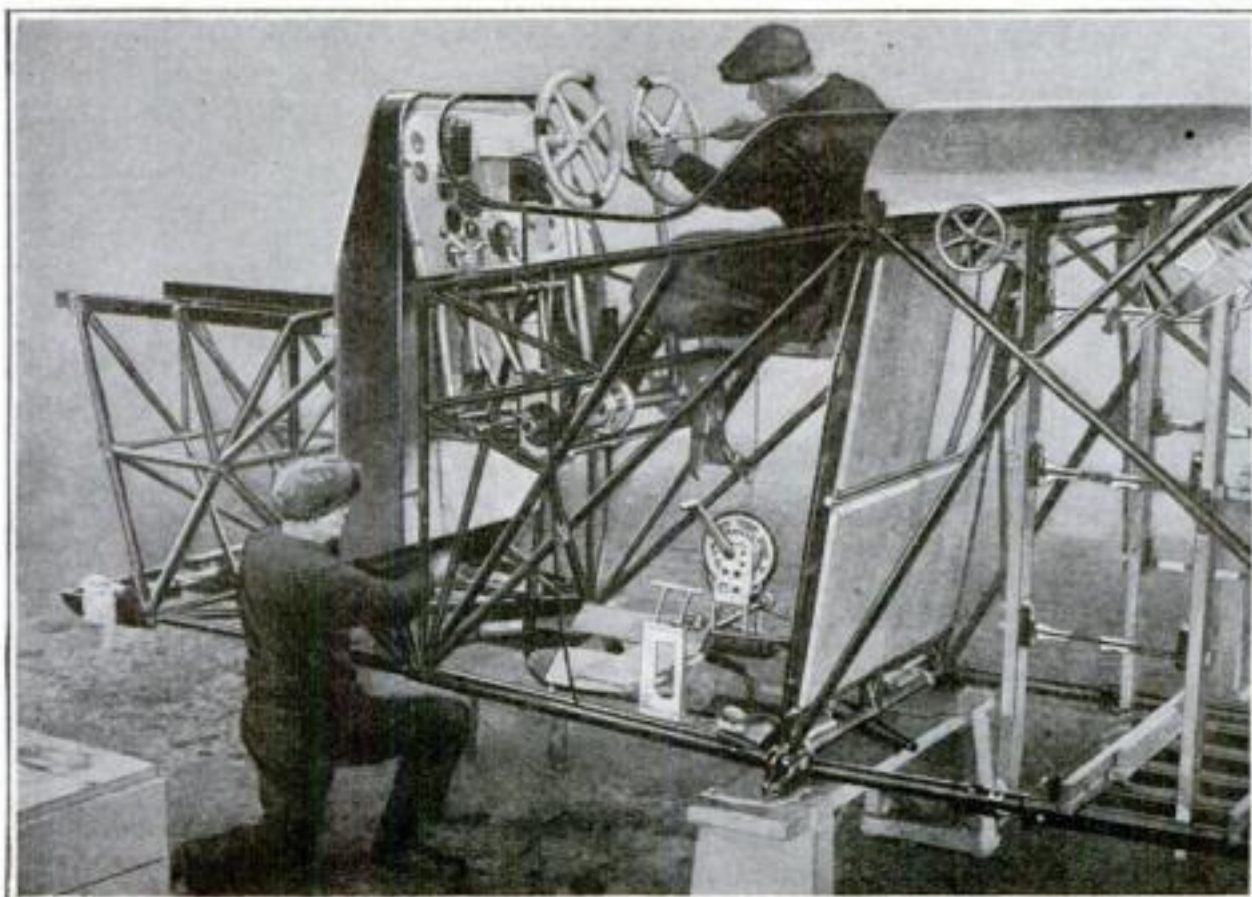
She Changes Planes in Air for Thrill

Miss Gladys Engle, Don MacDougall, and Art Gobel, who do aerial stunts for the thrill of it, recently had all Los Angeles gazing up into the sky spellbound, as they performed their daring feats high above the city. Miss Engle made the spectators gasp as she coolly climbed from one plane to another. The picture above shows the two planes and Miss Engle as she was about to make her thrilling change. At the left, a close-up shows the daring flier poised to catch hold of the second plane

Uncle Sam's New Bombers Made for Speed

A dozen new, light, bombing planes, embodying features far in advance of those now in use, are being built for the United States by the Huff-Deland Airplane Company, at Bristol, Pa. These planes will have a speed of more than 135 miles an

hour and have been given the class name of "Pegasus." The pilot's cockpit of one of these new bombers is shown below, without the outer housing that will hide its metal frame and complicated system of controls when it is finally completed



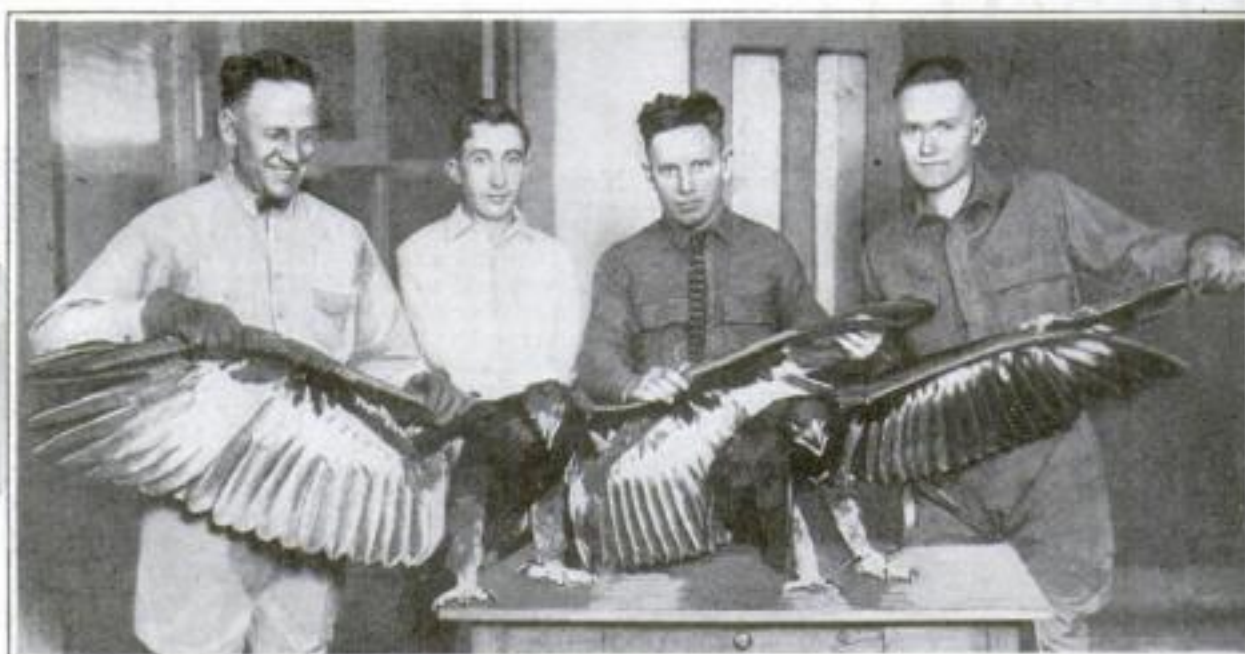
Builder of New Speed Planes

Thomas H. Huff, whose picture appears above, is the president of the Huff-Deland Airplane Company of Bristol, Pa., to which Uncle Sam has entrusted the construction of all the new light bombers of the speedy "Pegasus" type

When the American Eagle Is Captured



James R. Gillen with an eagle captured in the Pennsylvania mountains after a storm



Two fine specimens of American eagles, and the four Utah National Guard officers who caught them in the mountains of Utah. Note especially the magnificent spread of their great wings

AFTER a recent storm James R. Gillen, of Ambler, Pa., found an American golden eagle near Fort Washington, almost dead of exhaustion from battling the elements. It was too weak to resist, and Gillen took it home. The bird has now fully recovered but is still in captivity. It is not yet full grown, but it has a total wing spread of fully six feet four inches.

Officers of the Utah National Guard tramping through the mountains near Bountiful, Utah, discovered two American eagles on a ledge. Stealing up on them, they seized the great birds before they could get away. The struggle that ensued was lengthy and fierce.

The eagles fought with beaks and talons and were subdued only when completely exhausted. The officers were bitten and scratched, and their clothes were in ribbons when the battle was over.

Although captives, there is still fight in the birds, as the picture shows.

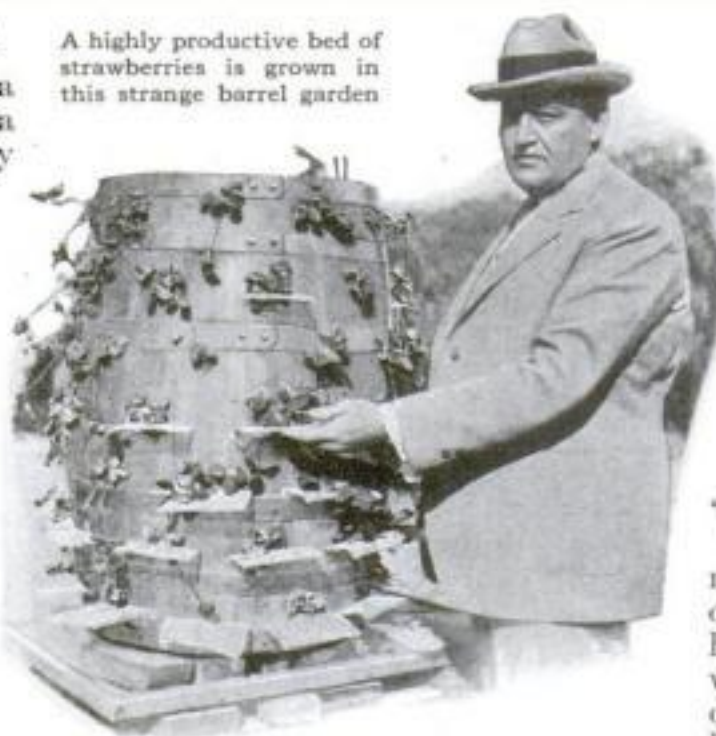
Strawberry Patch in a Barrel

STRAWBERRIES enough to supply a family for a season can be grown in a barrel. This has been demonstrated by Delavan D. Johnson, of California, as shown at the right.

A barrel in which holes of sufficient size for a strawberry plant have been bored, is filled with dirt. In each of the holes a vine is set, and under each vine is built a screen platform to support it as it grows and bears fruit. The barrel is set on a platform some distance from the ground, to make stooping unnecessary.

As many as sixty vines can be raised in one barrel. By this method hundreds of vines can be cultivated in a restricted area. The berries are said to be better, too, because they get more sun and air and are not so cramped as when they grow on the ground.

A highly productive bed of strawberries is grown in this strange barrel garden



Blame Snails' Sweet Tooth

A SMALL snail causes the root-rot disease, which has almost wrecked the sugar growing industry of Louisiana, the United States Department of Agriculture has announced. As many as 150 of these little snails have been counted about the roots of a single plant. In their attack they leave cavities which are invaded by micro-organisms from the soil.

"13" His Lucky Number

"GIVE me the thirteen every time," says B. A. McGoldrick, lumber manufacturer, of Spokane, Wash., who declares this number the luckiest he ever had. If he failed to get an auto license without a 13 in it, he would be greatly disappointed. For the last six years he has had the number 13,000, and in all that time he hasn't been arrested or had an accident. He carries the six numbers in a special frame in front of his radiator.

Three of These Texas Lemons an Armful

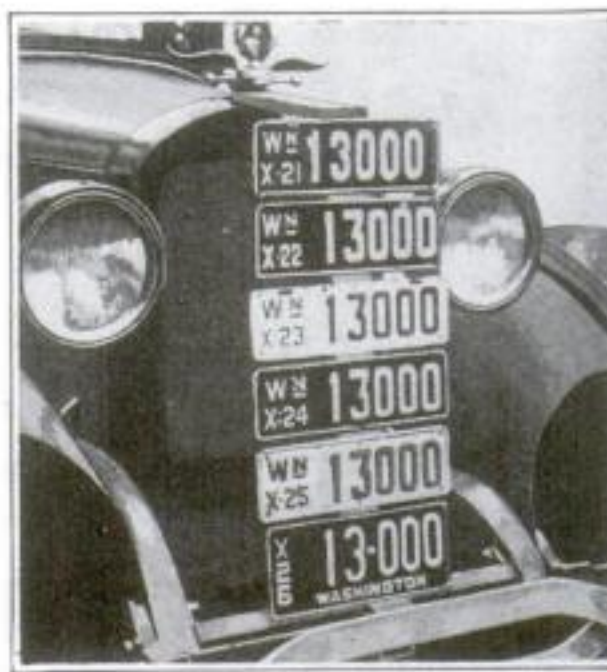


Lemons as big as grapefruit, called "Ponderosas," as shown above, are raised in the lower Rio Grande valley in Texas

A GALLON of juice to a lemon! That is the way they figure for lemonade in the lower Rio Grande valley, Texas. This is, of course, an exaggeration. But you may not think it very much out of the way when you note the size of the lemons.

Three of them make an armful, as may be observed in the picture.

These lemons were part of a display of Texas agricultural products held recently in Kansas City, Mo. The name of the fruit is "Ponderosa," or, translated into plain English, ponderous.



The hood of the automobile of B. A. McGoldrick, who believes in number 13

Girl Artist Fashions Mosaics from Egg Shells



Miss Nellie Isaac making mosaics from egg shells by her newly discovered process

SKILLED workers, notably of China, Japan, Germany, and Italy, for centuries have employed sea shells in making odd and intricate ornaments. But for the first time, it is believed, hen's egg shells have been successfully used for a similar purpose.

After examining some specimens of the older shell work, Miss Nellie Isaac, a New York artist, was struck with the possibilities of the humble egg shell. She tried out her idea, and the result is a new craft—egg shell mosaics for the backs of brushes, for combs, powder boxes, pin trays, and mirror frames.



How the selected pieces of shell are arranged according to a chosen design and are glued to an article by skilful hands

The shells are broken into small pieces which are carefully fitted together according to the desired design, and are then glued on to the article to be deco-



Cleaning and breaking up the shells, the first step in the making of egg shell mosaics

rated. The utmost care is necessary in the handling.

When the glue has dried, the shells are painted in various colors. The surface of the finished egg mosaic is smooth and does not chip easily, making it almost as serviceable as the sea shell mosaic.

SIX CABLES are to be strung across a span of 6,240 feet, or nearly a mile and a quarter, to carry power across an arm of Puget sound into the city of Tacoma.

How You Can Grow a Pearl

IT IS possible for anyone to grow pearls such as the Japanese have succeeded in producing. Charles L. Edwards showed his nature study classes in the Los Angeles public schools how to do it.

He put a hard bead in an abalone shell and then left the mollusk alone. When he opened the shell, the bead was not to be seen. Instead, stuck to one wall of the shell was a pearl that the abalone had formed by covering the irritating bead with layers of pearl film, its own protective secretions.

A pearl stuck to the shell in this way is called a blister pearl. It is generally set in jewelry with one side flat, but it can be peeled like an onion to make it round. In doing this, however, its size is somewhat reduced.



The pearl on the shell, pointed out in the picture, was formed around a small bead



Postage Stamps Make Colorful Bedroom Set

CANCELED postage stamps have been put to many uses in the past, but Mrs. Josephine Farrell, of Winthrop, Mass., now has found a way of employing them that is both novel and artistic. She has used them to decorate a set of wooden bedroom furniture. Thousands of stamps of all denominations went into the clever and greatly varied designs, and the gay colors of the stamps produce a striking effect, as seen in the photograph.

Collectors have shown much interest in the furniture and have made many tempting offers for it. Henry Ford is reported to be one of those who have tried to purchase it.

Two MISSOURI farmers were startled recently by a meteor that landed only 300 yards from them. The meteor made a hole in the ground four feet in diameter.

Ideal Optical Glass Produced

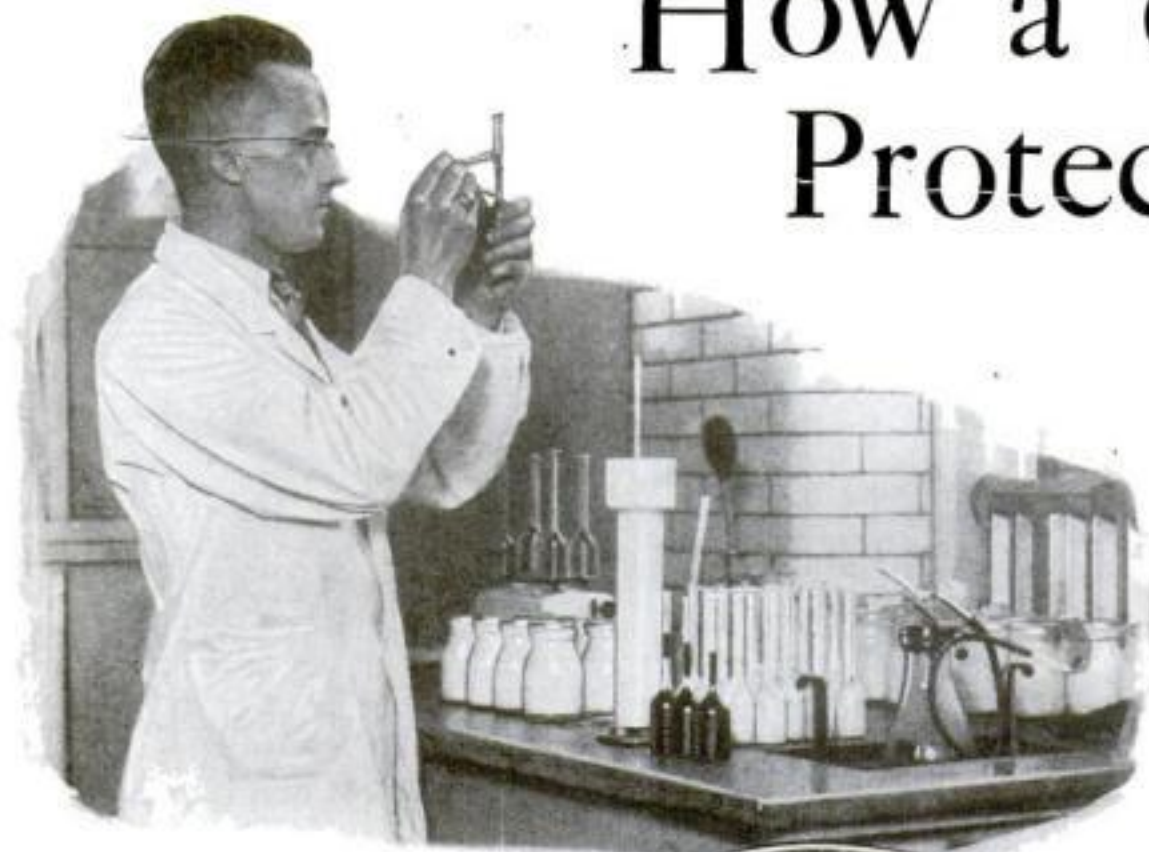
A PERFECT optical glass, free from all flaws that are sometimes found in optical glasses, has been produced at the United States Bureau of Standards where it is now on exhibition. The watch in the illustration was photographed through four inches of this glass, but every detail is as perfect as if there were no glass between it and the camera. There are none of the usual distortions caused by flaws or scratches.

In the original photograph, even the smallest divisions of the dial stand out with absolute distinctness.



The piece of glass, through which the watch was photographed as shown above, is four inches thick and absolutely clear and perfect

How a Great City Protects Its Food



He Guards the Milk of New York's Millions

Determining the percentage of fat in a milk sample in the milk laboratory of the New York bureau of food and drugs. Protecting the people from impure milk is perhaps the city's biggest task. About 3,500,000 quarts of milk are consumed daily in New York



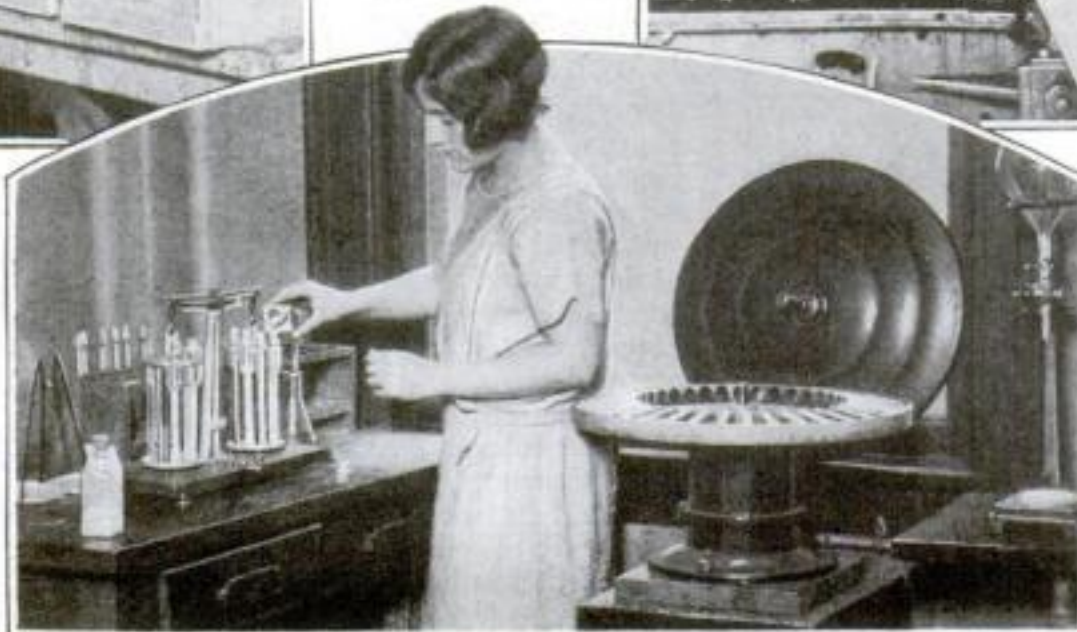
Wood Alcohol Menace

The photograph above, taken in the chemical laboratory of New York's health department, shows a chemist testing liquors for wood alcohol with an immersion refractometer. In these days wood alcohol has become a constant menace, and every effort is made to guard against it



Eggs Must Be Canded

New York consumes 55,000,000 dozens of fresh and storage eggs yearly. Besides these, other millions of frozen and powdered eggs are used for baking. More than a million pounds of frozen yolks and whites come into the city every year from China alone. These are tested by smell and taste, while the whole eggs are carefully candled. The picture above gives an idea of how eggs are candled



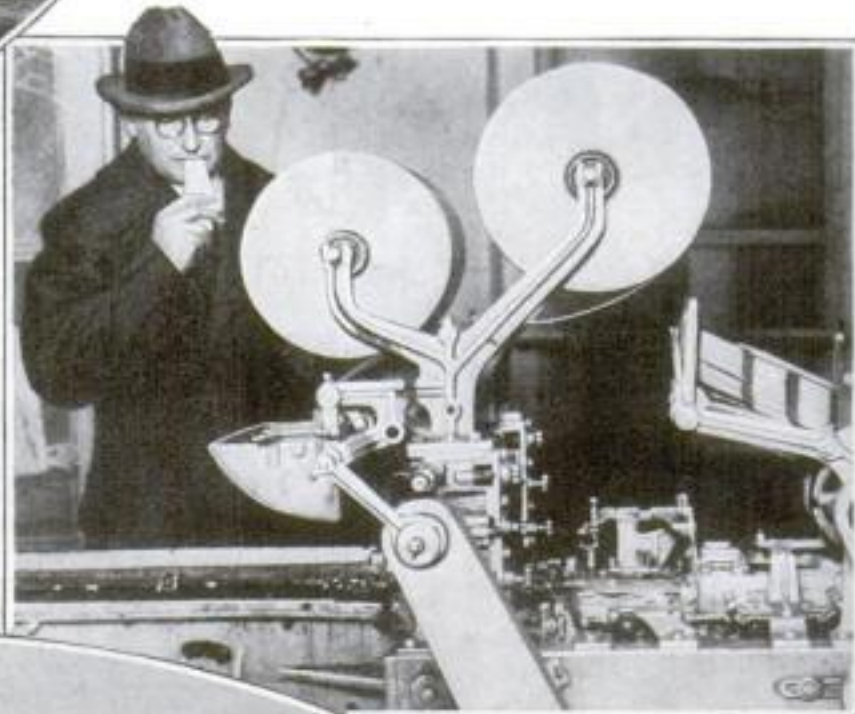
THE AMOUNT of food consumed in New York City in a single year would fill a freight train extending from Havana, Cuba, to Alaska! With its population of nearly 6,000,000 residents and—to follow a very conservative estimate—of 1,000,000 commuters, every day at lunch time 7,000,000 persons are eating in the largest city in our country. Fifteen thousand restaurants serve 3,000,000 persons daily.

These figures give but a slight idea of the vast quantities of food New York City needs, and the herculean task it faces to safeguard that supply. In a greater or lesser degree the same problems confront every city in the country.

From the time it gets to the terminals until it reaches the table, food in the giant metropolis is closely scrutinized by an army of inspectors. They board the trains at the stations and the ships at the piers. They follow it through from the wholesale markets, to retail establishments, pushcarts, bakeries and restaurants. For some foods, such as milk, and some kinds of shell fish, the inspection begins outside the city. A net of inspectors is spread through nearby states, examining foods at their sources.

Last year these inspectors condemned food enough to fill a train of cars four miles long. Spoiled, adulterated, and poisonous foods are quickly discovered by the keen-eyed, vigilant health guardians.

All doubtful foodstuffs are analyzed in two municipal laboratories, one for detecting impurities and adulteration, the other for examining milk. Both are maintained by the city under its bureau of food and drugs.



Tasting Butter

The purity of butter is decided by taste and odor. Dr. M. A. Herzog of the health department, above, is tasting butter before printing and wrapping

Ice-Cream Weighed

New Yorkers eat 15,000,000 gallons of ice-cream a year, or two and a half gallons per person. The fat content for all this ice-cream must be at least eight percent. At left, an assistant in the municipal milk laboratory is shown weighing a sample of ice-cream

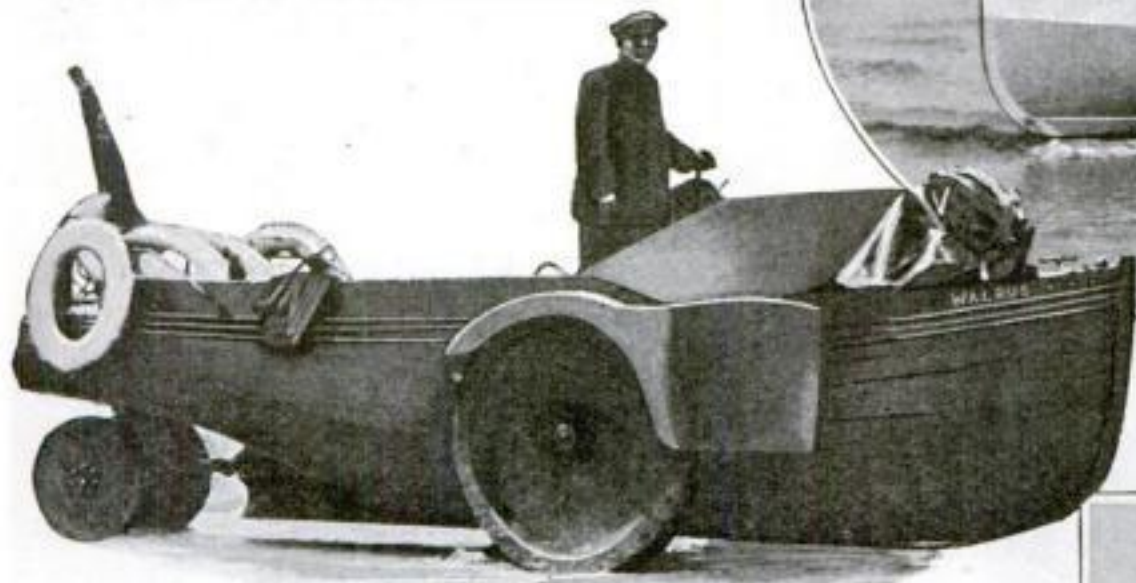
Boats for Land and Water

Half-a-Dozen Ingenious New Travel Ideas



Novel Sightseeing Motor Launch

The large motor boat coming up the beach, above, with a party of sightseers, is one of the attractions of Skegness, England. It runs on its own power on land and in water, and takes visitors along the beach and out on the sea



Takes Visitors Out to Big Boats

This motor boat, called the *Walrus*, is equipped with a Ford engine and is equally at home on land or in the water. It carries passengers from the beach at Scarborough, England, to larger boats in the harbor that take excursionists for a sail

Complete Boat on Auto Chassis

The boat, on the right, beginning to ascend the shore, is an ingenious combination of a specially designed boat body and the chassis of a low priced automobile. A lever changes from propeller to automobile transmission. It was designed by an Austrian



A Bicycle Runs This French Boat

The small boat above is built around a bicycle which furnishes propelling power for both land and water. Its inventor, Marius Gallee, a French tourist, can be seen here starting on a jaunt in it from Paris to Amsterdam, Holland

A Tricycle Boat

Dashing into the water, below, is a novel German tricycle boat that runs as well on land as in water. It is propelled by foot power, and is sufficiently large to carry four passengers besides the driver

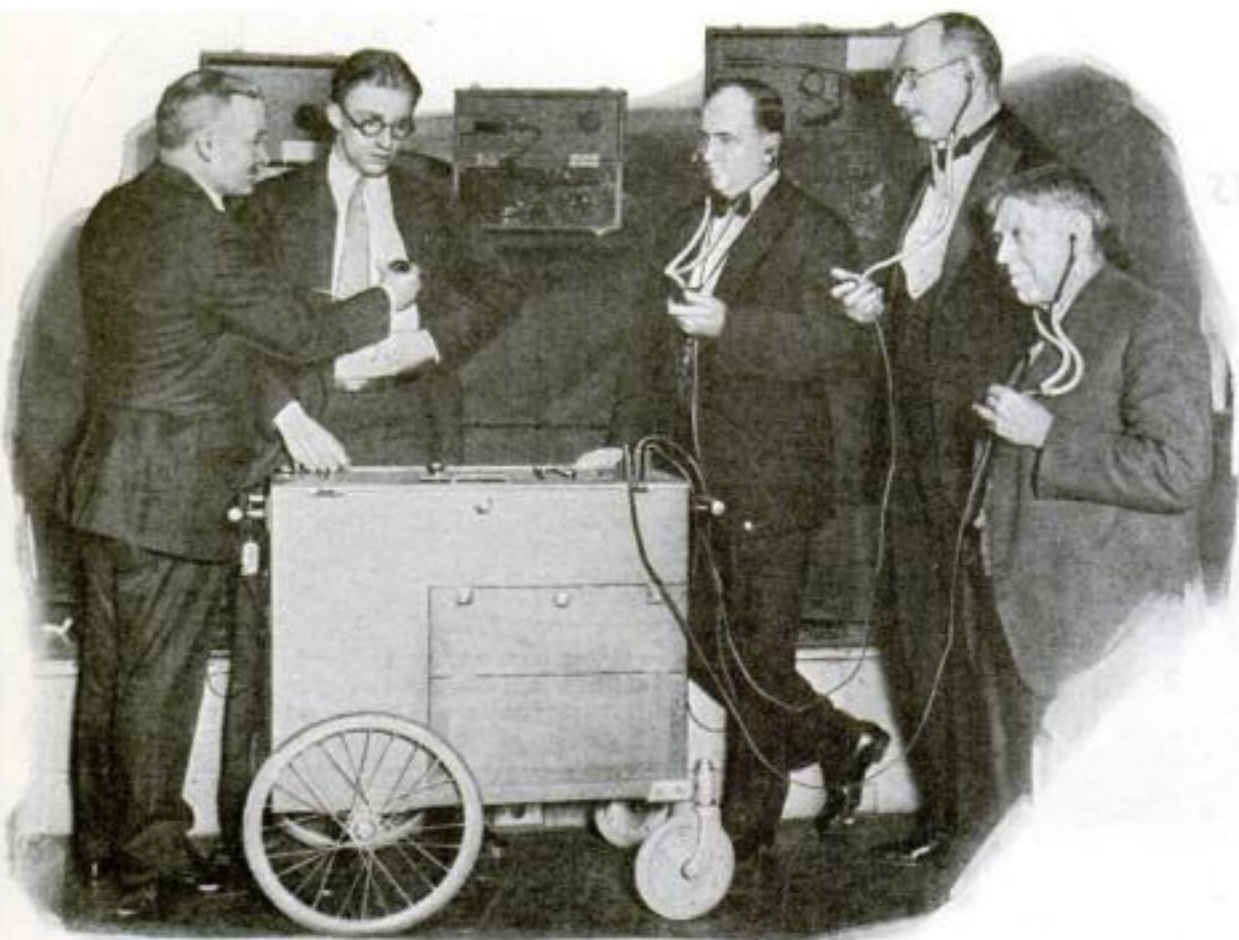


Handy Combination for Campers

The sidecar of the motorcycle above is a complete motor boat that can be detached easily from the motorcycle. It was recently put on exhibition at the Motorcycle Show held in the new Madison Square Garden, in New York City



Thought Messages Stir Controversy



A Thousand Persons May Hear Man's Heartbeats with New Device

It is possible, it is claimed, for as many as a thousand persons to listen to a man's heartbeats transmitted by a stethoscope, with a new device recently invented by engineers of the Bell Telephone Laboratories, New York. The photograph shows H. Clyde Snook, of the Bell laboratories, holding the stethoscope transmitter to a subject while three New York radio and electrical engineers listen in

Knowledge of the latest advances of science is one of the greatest assets of the mind. It develops depth of thought and breadth of vision. In its application to daily life, it is of immense value. In these columns we endeavor to give you each month brief accounts of the latest scientific discoveries that may be of practical service to you.

TELEPATHY soon may be added to radio, telephone, and telegraph as a means of communication with distant persons. Notable progress has been reported by Professor Vladimir Behterev of Leningrad Academy of Sciences, Russia, who, by capturing the electromagnetic waves thrown off by people, claims to have succeeded in transmitting thoughts.

Dr. Ivan Chakhovsky, a Moscow physician who took part in Professor Behterev's experiments, substantiates this claim, and declares that in seventy percent of the cases Behterev was successful.

Professor Behterev's is the third announcement from Russia recently on telepathy. In 1925, Professor Skripsy of the Leningrad Electro-Technical Institute told of an invention to determine everybody's "electric characteristics" by recording human electromagnetic waves. Early this year, Dr. Koshinsky of Moscow claimed to have transferred human thoughts from one person to another.

American psychologists are for the most part skeptical of these claims. Some reject them entirely. Dr. J. McKeen Cattell, formerly of Columbia University, and Dr. Edward L. Thorndike of Teachers College, New York, doubt the success of the Russian experiments. Professor Couvel, head of the psychology department of Stanford University, which six years ago

received \$800,000 for psychic research, recently declared, after 10,000 attempts, that telepathy is impossible.

New Uses for Ultra-Violet Rays

NEW uses for ultra-violet light, that invisible part of sunlight whose magic effects on health were discovered only recently, are being found almost daily. In Paris, the powerful light is being used now to bring out texts that have been erased from old parchments. Even though the parchment has been written over again, it is said, the original letters will come out. Very interesting discoveries of old classics are expected to be made under this treatment.

The Maine Agricultural Experiment Station recently has been giving cows a daily bath of ultra-violet light from artificial lights. The milk that these cows give, it has been found, prevents rickets in babies, while milk from cows not getting treatment is useless in preventing the disease.

Progress of Science at Home and Abroad

In the summertime, cows out in the pasture get their doses of ultra-violet light from sunshine, but in winter stables this is denied them. The time appears near at hand when every stable will be provided with artificial sunlight for the long, cheerless winter days.

A Lead Cancer Cure

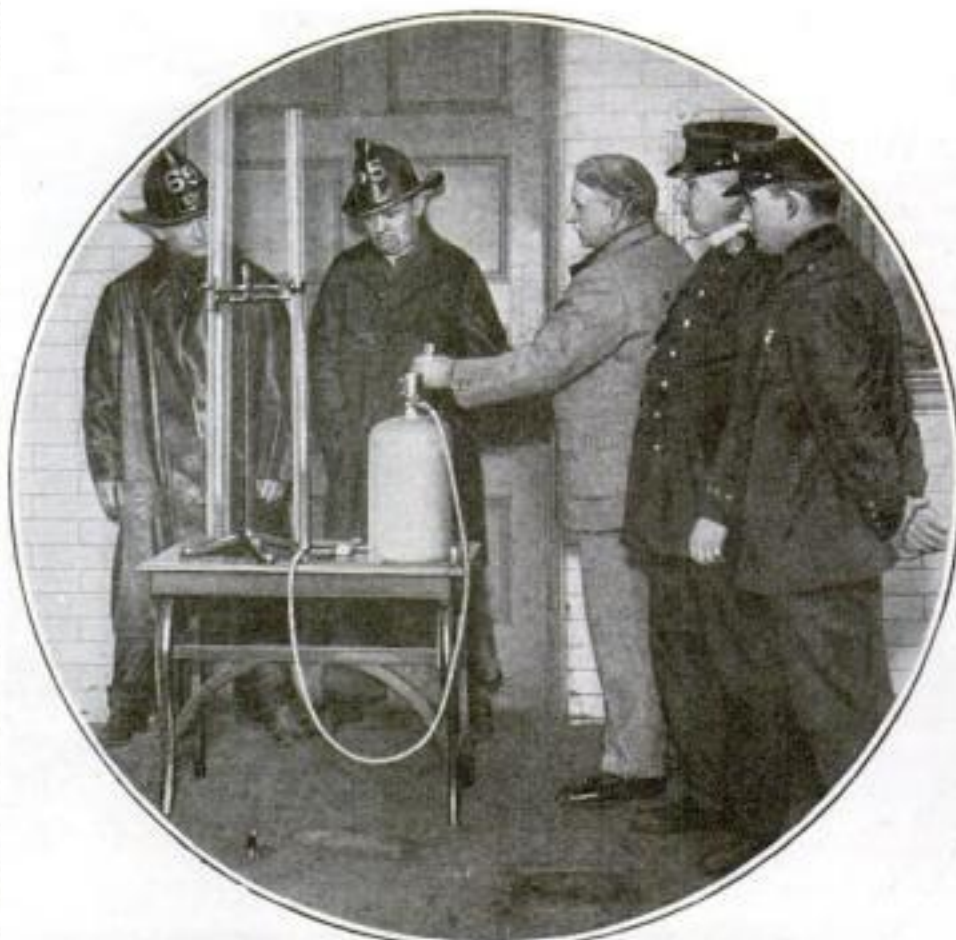
NEW hope has been given recently to sufferers from cancer. A distinguished English surgeon, Dr. W. Blair Bell, claims that he has been able to cure the dreaded disease with injections of lead. A professor at the University of Liverpool, Dr. Bell has been testing out this method for seventeen years.

The metal is injected into the veins near the cancerous growth. Out of about 200 cases treated, most of them thought hopeless, Dr. Bell declares that almost fifty are now believed to be entirely and permanently cured.

A Novel Way of Keeping Fruit

AN ENTIRELY new way of keeping fruit from spoiling has been found by Professor John McLean Thompson of the University of Liverpool, England. He puts the fruit to sleep, he declares, in which state they breathe very slightly and keep perfectly for a long time.

The fruit is put in a room and kept at a steady temperature and degree of



Vibrations to Be Firemen of the Future?

Fires in the future will be put out by tone vibrations, according to Charles Kellogg, a California naturalist, who is showing New York firemen how it can be done. Each building, he says, will have its own pitch, and the vibrations produced by a "tuning-in" process will extinguish the fire



Relics of Ancient Babylon

Above, Miss Grace Stockman, of the Smithsonian Institution, Washington, D. C., is examining three inscribed clay disks dug up in ancient Erech, Babylon. The largest contains a schoolboy's exercise; the small ones are bills of sales for goats. They are about 4,000 years old.

humidity until it becomes dormant. Then it can be kept anywhere. The method has been tried on oranges, nuts, grapefruit, lemons, and apples.

If further tests prove successful, we may see on our fruitstands strange tropical and oriental fruit that never reached our country before on account of the prohibitive cost of cold storage shipping.

Blackbird Best Singer of Tribe

IN A singing contest between birds, the blackbird would win, said Professor C. J. Patten of the Royal Institution, London. For the blackbird keeps the best time and rhythm, and his song has the best tune. A thrush, however, could beat him in endurance, some thrushes being able to sing sixteen hours a day.

Birds have three kinds of language, the professor says—alarm notes, call notes, and song. Alarm notes are for trouble, while call notes are used by young birds crying for their parents or by older birds when mating. Songs that we think are expressing joy, this bird specialist says, actually are not. Most birds really are saying, "Look at me—how big I am—how beautiful I am—I'm a very fine fellow"; in short, the songs are expressions of pride.

IN THE laboratories of Princeton University, a new way has been found to make hydrogen peroxide by combining hydrogen and oxygen directly. Shortening the process will mean cheaper antiseptics and perhaps cheaper dress goods, since hydrogen peroxide is one of the most important bleaching agents.

France Leads in Flying Records

FRANCE leads the world in aviation, having forty-five world's records. The United States comes next with thirty-three, with Italy third and Denmark and Holland tying for fourth place. These figures are given in a new chart published by the French air ministry.

Lucien Boussoutrot, a French airplane pilot, recently made a world's record for altitude and duration of flight with heavy loads. Carrying a weight of over six tons, equal to that of sixty passengers and baggage, he rose 11,482 feet in fifty-five minutes and remained up one hour, twelve minutes and twenty-one seconds. In this flight Boussoutrot broke eight previous records, seven of which he himself had made previously.

Men Think Better under Strain

YOUR easy-going, pleasant fellow isn't going to get there as fast as the man who grits his teeth, knits his brows and holds his muscles tense.

A series of psychological tests was tried on persons while they were gripping a dynamometer, a pair of hand grips with meter attached, and then repeated when the subjects were sitting in relaxed positions. The results showed that the persons could think much better and faster when their muscles were under tension.

A Rockefeller Gift to Egypt

A GIFT of \$10,000,000 for the erection and maintenance of a vast museum and for the establishment of an archaeological institute in connection with it at Cairo was recently offered to King Fuad and the people of Egypt by John D. Rockefeller, Jr. This sum, believed to be the largest ever devoted to archaeological studies and research, was proffered as an expression of the friendship and respect America, the newest of lands, holds for Egypt, the oldest nation in history.

Egypt's wealth of ancient monuments and marvelous pieces of art has increased in late years beyond the capacity of the present museum of Cairo. A research institute in connection with a new museum



Cure Found for X-Ray Burns

A cure for X-ray burns, that have claimed so many victims among doctors, has just been announced by Professor d'Arsonval, the noted French scientist, shown above. With high-frequency currents, d'Arsonval recently effected a complete cure for Dr. Debedat, a Bordeaux radiologist. D'Arsonval, whose special field is electricity, after years of research recently declared that death by electric shock is preventable, and efforts to induce respiration immediately following a shock should be continued at least two hours. In the photograph, Professor d'Arsonval is standing at the high-frequency machine used to effect his remarkable cures.

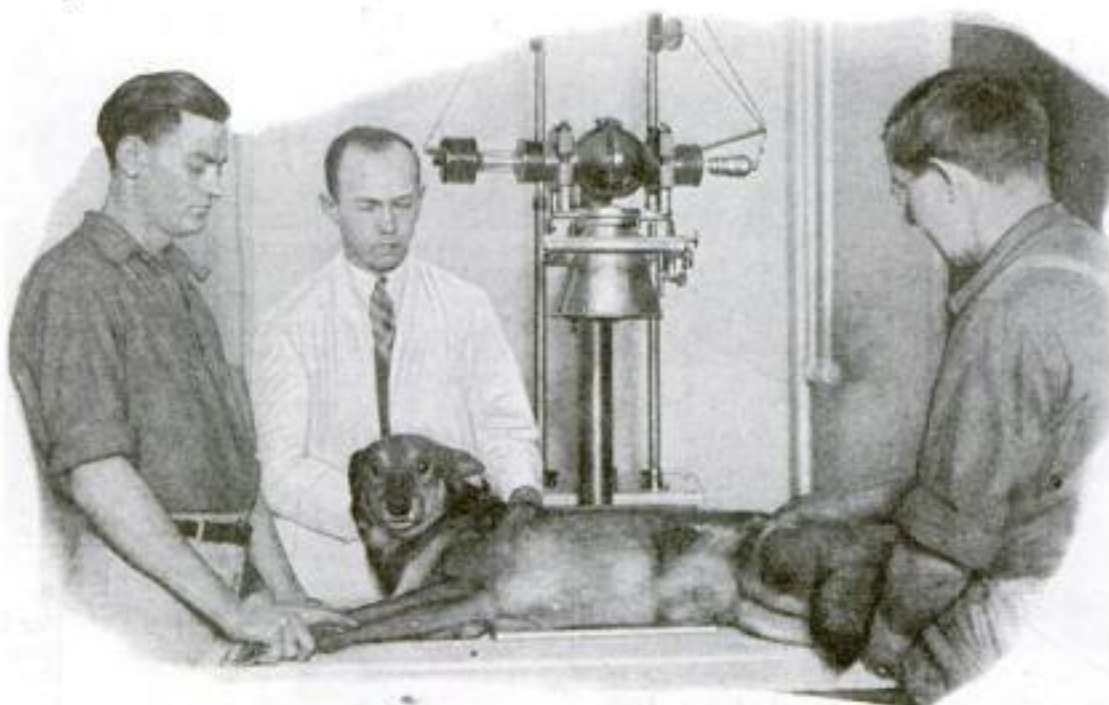
will be of untold service to scholars from all parts of the world in following out their studies of early Egyptian history. It will also provide the best scientific training for students from Egypt itself.

Building Material Made of Straw

A NEW fireproof building material called solomite is a recent French invention. It is made of straw, and is cheap, light, durable, and soundproof. The straw is pressed into large panels nine feet long by six feet wide and two inches thick, bound together lengthwise by wires six inches apart. The heavy pressure to which it is submitted and the mineral content of the straw combine to make it thoroughly fireproof.

The material has been found to be excellent for side walls, ceilings, and partitions, and makes a fine surface for plaster and stucco. It has been used extensively recently for summer cottages and for the soundproof booths in phonograph and radio stores.

TO FIND a serum for pneumonia, one of the nation's most deadly diseases, Lucius N. Littauer of Gloversville, N. Y., a former congressman, who lost his wife from this deadly disease, has given \$10,000 a year to New York University.



X-Ray Used in Treating Animals

The Ellin Prince Speyer Hospital for Animals, New York, which treats thousands of ailing animals daily, is said to be one of the finest of its kind in the world. The picture, taken in the X-ray laboratory of the hospital, shows a surgeon X-raying a dog.

Novel Devices Lighten

Eighteen Handy Ideas, All Designed to



It Mixes, Beats, Polishes and Grinds— All with One Motor

A servant is scarcely needed in the kitchen equipped with so versatile a machine as that shown above. It does all sorts of kitchen tasks. It does mixing and beating, polishes silverware and cutlery, grinds meat and coffee, slices vegetables, crushes ice, turns the ice-cream freezer and sharpens knives. The remarkable thing about this kitchen unit is that only one small motor is used to do all of these kitchen jobs. The grinder, beater, and so on, are separate attachments, which can be quickly clamped on or taken off the device.



For the Nightly "100 Strokes"

The maker of this hair brush had a new idea. He put its handle on the side instead of on the end and made it half as long as the ordinary brush handle, so that it can be packed in less space. The brush may be cleaned in boiling water without harming or loosening the bristles.

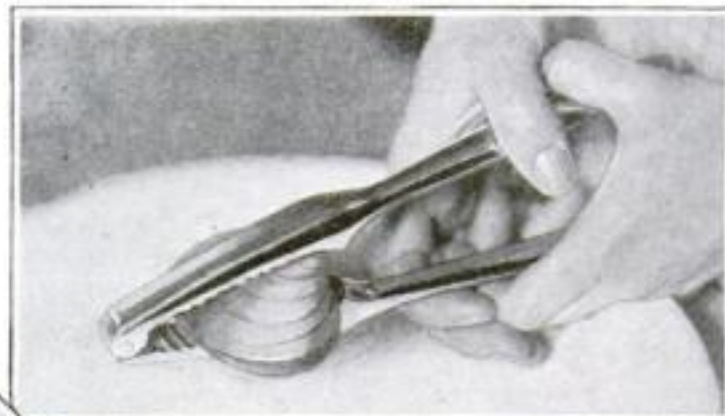


Egg Cutter Prevents Waste

Opening boiled eggs served in egg cups is usually a messy and wasteful performance. The little scissors pictured just above does a clean job, cutting the top of the shell quickly and evenly.

A Useful Long Fork

At last the elusive olive or pickle at the bottom of the tall bottle is beaten. The fork, below, will get it. It is just a long wire with a handle, and a crook at the end, but it will often prevent exasperation at your picnic.



Cracks Open Clamshells

Somewhat like a nutcracker but far more powerful is this tool (above), that will break open clams for you. The rough sides grip the clamshell firmly, and pressure does the rest.



Unique Vegetable Mincer

Sharp revolving knives in the single tool, shown above, mince cabbage and other vegetables in half the time it takes with an ordinary chopper. To work it, you simply push the device back and forth.



A Hook that Folds Up

When not in use, the garment hook at the left springs back into its recessed holder so that it is entirely out of the way. The weight of a cap or any garment hanging on it holds the hook down, but when it is taken off, the hook snaps back to its recess. It is easily screwed to a door or to a closet wall.



A New Way to Cook

For the bachelor girl who has no grill, here is a capital idea. Turn your electric iron upside down, slip it into this metal device that clamps, as seen in the picture above, on the edge of a table, and there you have a cooking plate. The holder will support any size of iron you may happen to have. Careful cooking won't spoil the iron.

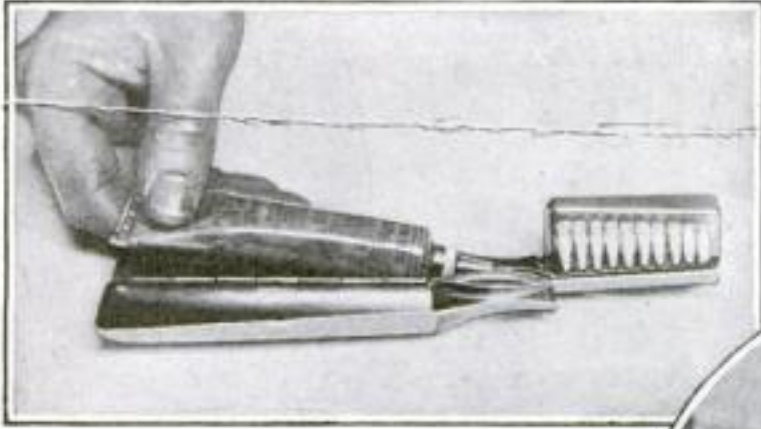


Five Tools in One

A most useful article around the kitchen and the house is the compact handy combination tool, illustrated at the right, that will sharpen knives with a few strokes, remove milk bottle caps, turn screws, remove fruit jar lids, and open bottle tops.

Tasks of the Household

Save Time and Energy for the Busy Woman



Toothbrush Carries Its Paste

This toothbrush carries its paste in the handle. Pressure on the tube forces paste on the bristles. The brush can be replaced. A metal cover slips on the brush when not in use, and the handle folds over the tube.

For Quick Pastry Making

A pie that is made in a hurry will be just as good as any other pie, if the crust is properly mixed. The device below insures proper mixing in a few minutes. It is boat-shaped, and made of fine crossed wires which blend the flour and fat together in record time.



An Apple Corer with a Spring

The particular advantage of the apple corer at the left is that the core can be removed just as far as is wanted. The bottom can be left in the apple to retain the juices and sugar in baking. A spring cuts the apple clean.



Removes Corn from the Cob

Corn slitter and creamer is the name of the little tool below, at the right, that helps in preparing sweet corn. Little teeth slit the kernels open while a flat edge scrapes out the contents as the device is pushed down the corncob.



New Mop Is Self-Wringing

A twist of the plunger in the handle of this mop wrings the mop dry. The mop fabric is removed very easily and, having a firm crosspiece at the bottom of the mop, it can be used to rub hard on spots on the floor.



This Drainer Doesn't Drip

One disadvantage of the ordinary sink drainer is that it drips water as its contents are being carried to the garbage pail. This new drainer, above, has a tray that slips under it, giving it a watertight bottom while being carried.



Library Table Hides Complete Electric Kitchenette

Apparently a Queen Anne table, when dinner time comes this attractive piece of furniture discloses itself to be a complete kitchenette and dining table combined. When you lift the top up you find not only an electric grill and toaster, but the electrical outlets as well, right in the table. One master cord connects the table with the usual wall outlet.



A Brush for Cleaning Combs

You can clean your comb in a jiffy with this new brush, made especially for that purpose. The brush rotates as it is pulled across the teeth of the comb.

Radio Builders Win Prizes

*Judges Announce Cash Awards
in Our Unusual Construction
Contest—How to Build a Set
Like the First Prize Winner's*



This Receiver Wins First Prize—\$150

Francis Carter Turner, of Middleburg, Va., who designed and built this remarkably fine set, is shown in the oval above. By occupation a farmer and stockman, he has made radio a hobby for years. Complete, detailed instructions telling you how to build this prize winning set efficiently and economically are given on these pages

FROM hundreds of entries from all parts of this country, Canada and the Philippines, the officials of the Popular Science Institute of Standards acting as judges have selected the prize winners in our Radio Construction Contest, which was announced last December.

This contest, which was open to radio fans everywhere, called for ingenuity and careful workmanship. From a given number of instruments and parts, and from a specified wiring diagram, contestants were asked to build a complete radio receiver—the very best possible. Entries were made in the form of photographs of the completed receiver, from which the judges selected those which gave evidence of the best workmanship. These, then, were put through actual working tests in the laboratory of the Popular Science Institute of Standards.

Five receivers were chosen for the final elimination, and when they had been received at the Institute's radio laboratory, they were put through the same tests applied to all the commercial receivers which are sent in for approval.

The three prize winning sets are all excellent examples of radio design and construction, the judges declare. All three tune sharply and bring in stations in a way to satisfy the most exacting radio fan. Their makers have reason to be proud of them. The prize winners are as follows:

First Prize, \$150—Francis C. Turner, Middleburg, Va.

Second Prize, \$50—B. O. Burgin, Albany, N. Y.

Third Prize, \$25—Raymond Hoffman, St. Mary's, Pa.



The Winner of the Second Prize—\$50

The builder of this set is B. O. Burgin, of Albany, N. Y. (above), head of the science department of the Albany High School. His workmanship is faultless, and the design embodies novel ideas in cushioned socket construction. Each tube socket is supported by live rubber so that jarring the table cannot cause ringing noises. All the connections to the socket terminals are made by flexible leads



Third Prize Winner—\$25

Raymond Hoffman, of St. Mary's, Pa., built this neat and efficient receiver. He used a glass panel mounted in a cabinet with sloping front

Honorable Mention—Robert Black, Easthampton, Mass., and A. Thomas Nieman, Chicago, Ill.

Mr. Turner's receiver is, in the opinion of the judges, one of the finest three-tube regenerative sets they ever have examined. The design not only is unusually attractive, but is almost perfect from a theoretical point of view. The mechanical construction is equally excellent.

The cabinet in which the prize winning set is housed is odd and original, for it is in the form of a sea chest. Since, however, cabinet construction was not to be considered in awarding prizes, the judges noted only that the receiver was fitted properly into the space provided for it and that the complete set was pleasing in appearance.

Because of the dimensions of the front panel, you will find, if you build this set, that it will not fit in any of the standard sizes of radio cabinets. It will be up to you, therefore, to decide whether to build a sloping front cabinet or a square cabinet for a vertical panel. The only

change necessary in making the panel vertical will be to alter the angle of the brackets holding the sub-panel to the front panel.

The winner of the first prize is an old-timer at the radio game. Although his regular business is farming and stock raising, he tells us that radio has been an absorbing hobby of his since away back in 1909—before broadcasting was even thought of.

"After making a selection of parts to build my contest entry," he writes, "I provided myself with several sheets of paper, a ruler, square, pencil, and plenty of elbow room. Then there began what closely resembled a chess game. The radio parts took the place of men, and after I had moved them about until I secured an arrangement that looked promising, I marked their positions on the paper and started in all over again with a fresh sheet. Eventually I hit on the arrangement that was incorporated in the radio receiver that I built for the contest."

TO BUILD a radio receiver like Turner's, first decide on the parts you will use. Almost any standard parts will do, and you can be sure of their efficiency if you purchase only parts approved by the Popular Science Institute of Standards.

These are the parts you will need:

A, B, and C—Any standard three-circuit tuning unit.

D—Variable condenser (straight line frequency or plain type with capacity to suit coil B of the tuning unit).

E—Fixed grid condenser, .00025 mfd.

F—Fixed condenser, .0005 mfd.

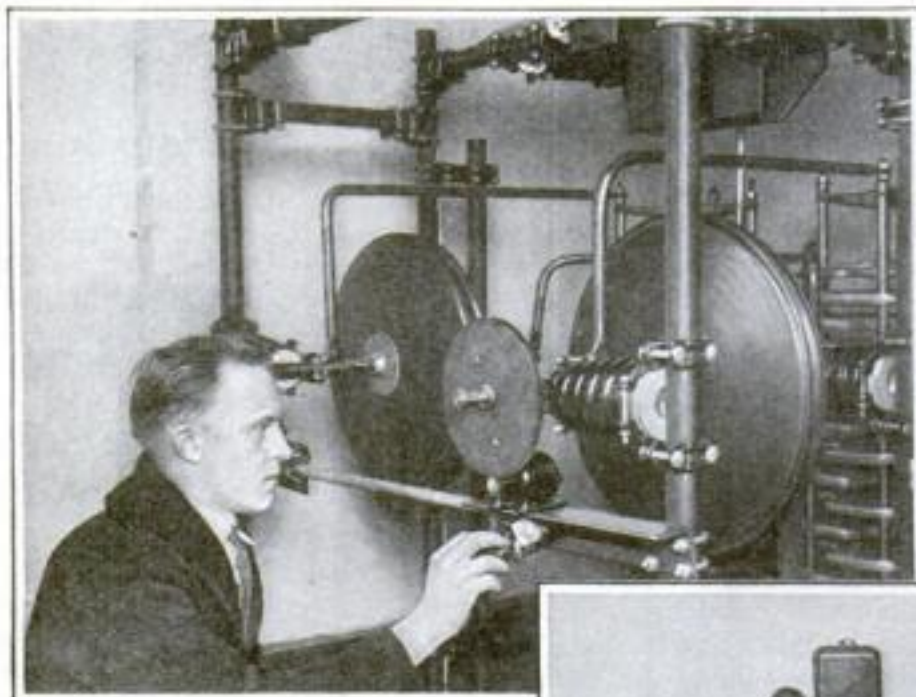
G—Fixed or variable grid leak.

H, J, and K—Rheostats.

L, M, and N—Vacuum tube sockets.

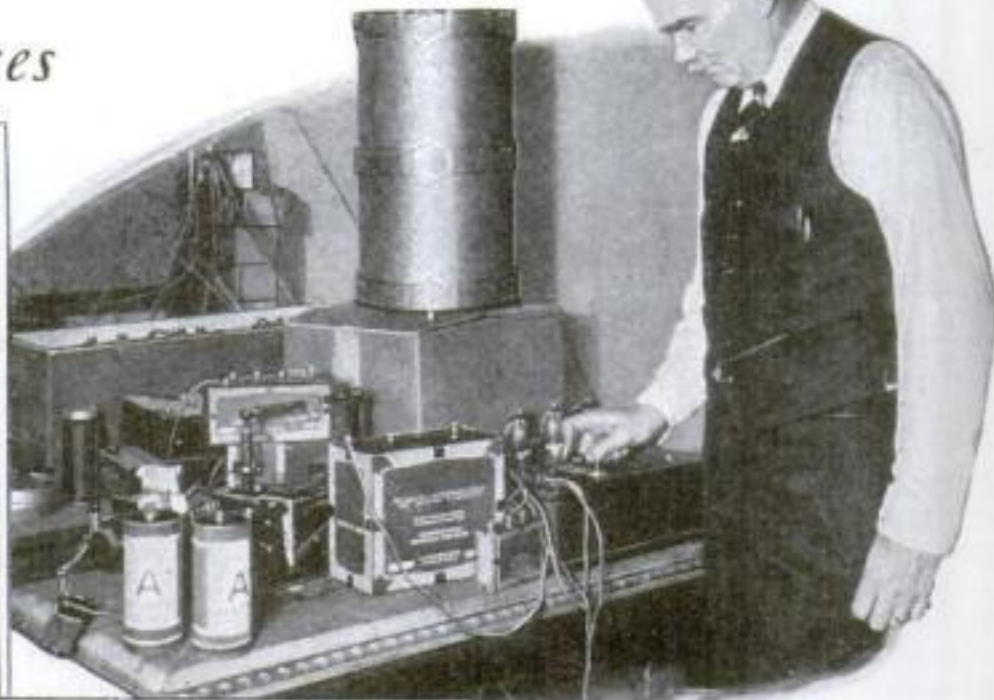
Radio – Here *and* There

Some New Ideas and Devices



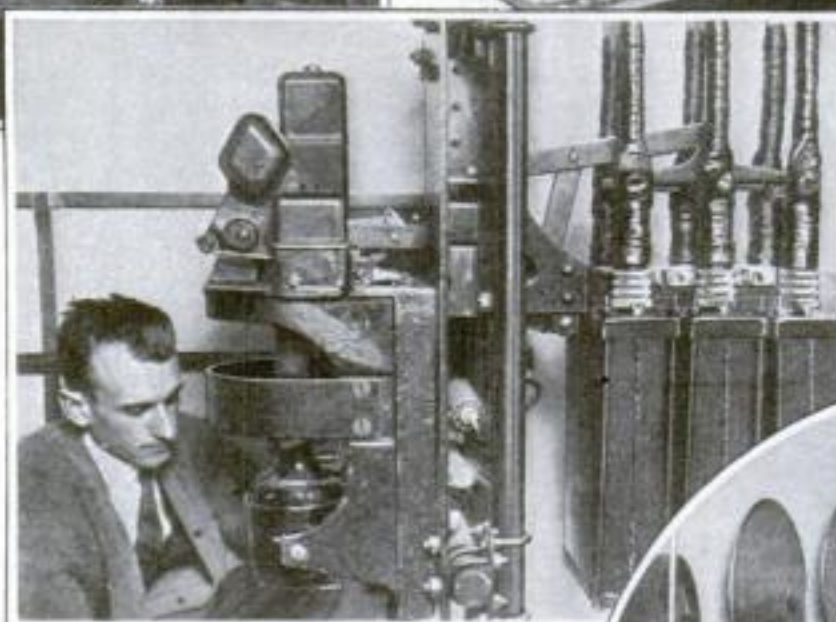
WJZ's Giant Apparatus

Handling fifty kilowatts of power at WJZ's high power station at Bound Brook, N. J., is quite a problem. Extraordinary means have to be taken to operate the controls because of the high voltages and the enormous amount of current carried in the various circuits. Above is shown a pair of vernier condensers used for tuning the antenna circuit. A small electric motor drives through a gear cut from an insulating compound to change the adjustment. At the right is one of the huge, motor operated oil switches. Practically all of these powerful switches are controlled by relays from the control room.



A Cylinder Loudspeaker

Dr. Lee De Forest has just invented a new type of radio loudspeaker that is shaped like a cylinder. The surface is made of thin material, and the sound is sent out in every direction with equal intensity. It is claimed that the construction of the loudspeaker is such that it is almost entirely free from blasting and distortion on the extremely loud signals.

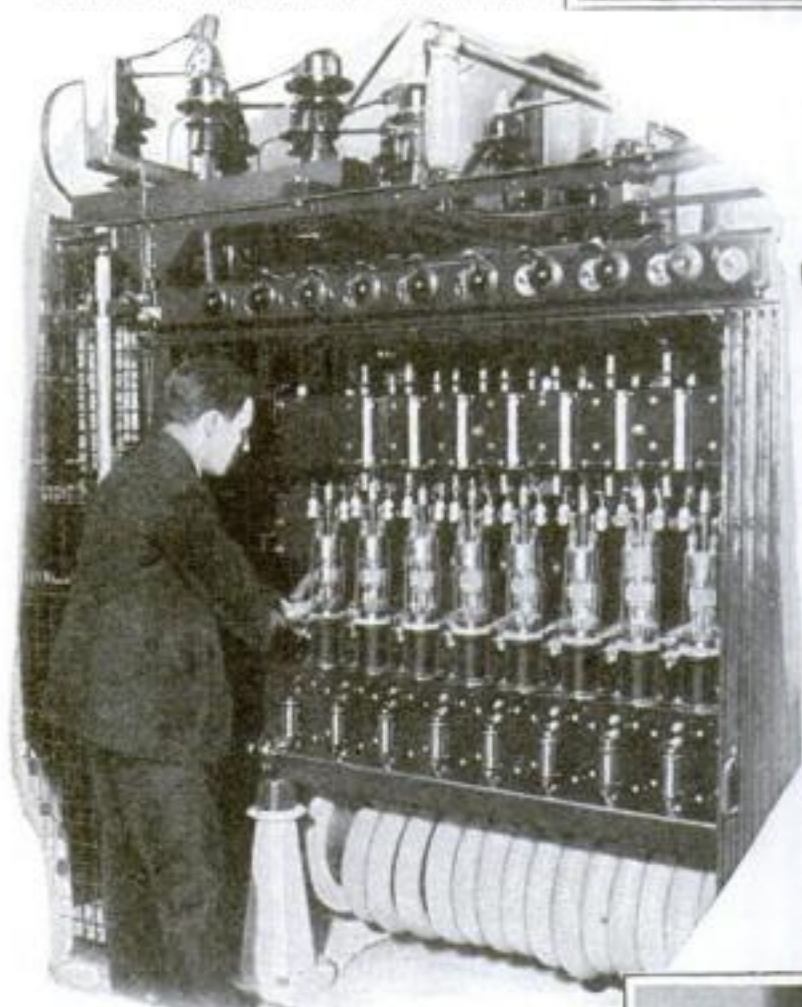


Novel Loudspeaker Test

In order to test the quality of reproduction of various types of loudspeakers, J. D. R. Freed of New York, above, arranged thirty-two of them in rows on shelves and connected them to a master control switch so that he could shift instantly from one to another. A tiny electric light bulb is mounted in front of each of the loudspeakers and connected in such a way that it lights up when the particular loudspeaker in front of which it stands is being used.

Drop a Nickel in the Slot and Tune-in!

After sixteen months' work, Joseph Pinto has completed the unique slot machine shown at the left. When you drop a nickel in, the machine is set in operation so that you can tune-in and listen to your favorite radio station for a limited time. It operates equally as well on either batteries or house current, and a red warning light flashes up one minute before the time is up.



The Tubes at Hillmorton

Here are the tubes that furnish the power for the new English broadcasting station at Hillmorton, England. When the station is actually in operation, a gate and railing prevent anyone from approaching as closely to the powerful vacuum tubes as is the radio engineer above. Tubes are water-cooled after the manner employed in high-powered stations.



Hints for Novices in Radio

How to Test Your B Battery

Other Helps to Better Radio Results

RADIO service men agree that at least ninety percent of the trouble calls are caused by dead batteries. Frequently it is the B battery that has become exhausted. The first indication that a B battery is nearing the end of its useful life is a slight decrease in the volume of sound, accompanied by noises that often strongly resemble static.

A voltmeter is the best instrument for use in testing B batteries, but if you have no voltmeter it is a simple matter to test your batteries with the aid of a ten watt electric light bulb. Connect a piece of wire to one terminal of the battery as shown in the illustration and hold it against the metal screw threads on the

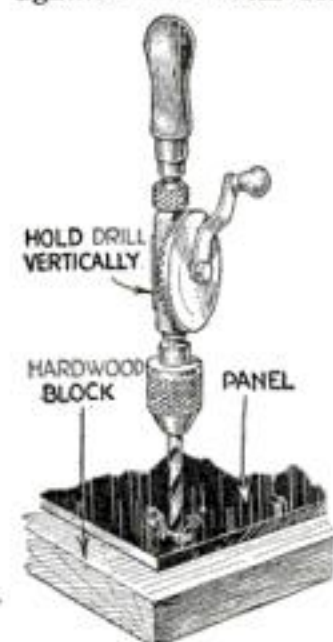
An easy way to test your B battery with a piece of wire and a small electric bulb



side of the base while you touch the metal button on the end of the base to the other terminal of the battery.

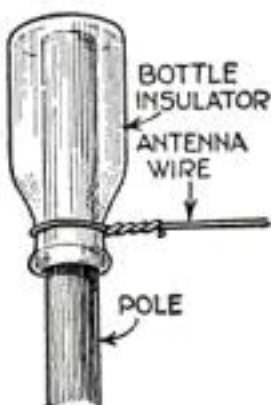
The bulb should light to about half of its normal brilliancy. If it shows only a very dull red or entirely fails to light, you may be sure that a new battery is needed.

DRILLING the panel for a radio receiver is simple if you use care and do not try to rush the



In drilling a panel, rest it on a block of hard wood to prevent bad edges around opening

job. Be sure to rest the panel flat on a piece of hard wood so that the point of the drill will not break through and tear out the material around the hole. In drilling large holes, it is a good idea first to drill the hole with a small drill—say one sixteenth inch. Then when you use the larger drill it will follow the small hole and will not drift to one side or the other. Take special care to hold the drill in a vertical position.



A bottle with a heavy rim fitted over a pole makes fine insulation for experimental or amateur-built antenna

IF YOU are putting up a temporary antenna for experimental purposes, here is an ingenious way to insulate the wire from the supporting pole. Any size or shape of bottle will do, provided the mouth is sufficiently large to fit over the end of the pole and there is a fairly heavy rim which will prevent the wire from slipping off the bottle. An antenna of this type is particularly good

in rainy weather, as the overhanging bottle prevents the leakage ordinarily produced by the continuous path of moisture between the antenna wire and the ground under pole.

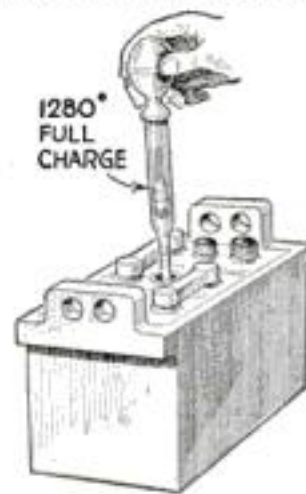
MOST new radio fans are under the impression that a storage battery is simply a box in which electrical energy can be stored like water in a tank. And the consequence is that they treat the storage battery as they would a water tank. In other words, they use it till the tubes will not light any more, and then they recharge it or have it recharged at the nearest service station.

This conception of the function of a storage battery is responsible for the short life of many batteries. The storage battery is not a place where electrical energy is stored. What actually happens when you pass direct current through a storage battery is that a chemical change takes place in the material in the plates. Then when you draw current out of the battery another chemical action goes on which results in the production of an

electrical current. But this chemical action only takes place properly when conditions are right, and that means that you must not mistreat the battery by letting it stand in a discharged condition. When a storage battery is allowed to stand in a discharged condition, another and very injurious chemical reaction sets in and gradually renders the plates incapable of performing their proper functions.

There is only one way to treat a storage battery, and that is to test it regularly with a hydrometer; and whenever the little float inside the syringe sinks down in the solution that you draw up in the syringe by means of the bulb at the top until the figure 1200 or at worst 1150 shows even with the surface of the solution in the syringe of the hydrometer, connect up the weak battery with the charger at once.

MANY of the latest types of vacuum tube sockets have both filament terminals marked F instead of F— and F+, because it does not make any difference which way the current flows through the filament. What you must watch out for, however, is that the other wires in the hook-up are connected with the right filament terminal.



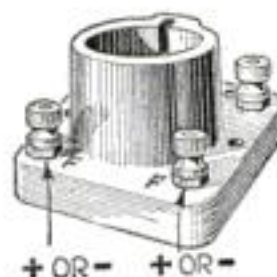
Your storage battery should be tested regularly with a hydrometer and always kept clean and charged close to 1280

In other words, it makes no difference which terminal you make positive or negative, so long as the wires to be connected to the minus filament terminal actually are connected to the filament terminal you have decided shall be minus.

Take the detector tube socket in any radio set, for instance, if you intend to use an amplifier type of tube in this socket as is the regular practice today,

you will find that there is a wire from the tuning condenser that is connected with one end of the tuning coil and which is also connected to the positive filament terminal of the socket.

To simplify your wiring, you may find it worth-while to connect the positive battery wire to the terminal of the socket that is actually marked minus instead of plus, and vice versa.



When filament terminals are not marked + or —, be sure to connect wires correctly to the terminals you select as positive and negative

A B C's of Radio

MANY beginners puzzle over the kind of wire to use in wiring up a set. For electrical efficiency, it makes no difference whether you use insulated or plain bare wire. Nor is it necessary to use heavy bus wire. Any wire down to size 24 will do as well from an electrical standpoint but, of course, the bus wire is better because it is not likely to sag out of place. Remember these points, for a good job:

1. Make each wire as short and direct as possible.
2. Solder or tightly clamp every connection.
3. Space all wires as much as possible, considering the arrangement of the instruments.

You Can Now "Turn on the Ice"

Electricity or Gas Operates New Home Refrigerators

EXTINCTION threatens the iceman. And all because modern science has made marvelous strides in perfecting small ice making machines for the home or apartment house.

With one of these outfits, your wife need not stay in half the day waiting for the iceman. There will be no more muddy footprints over the kitchen floor, nor ice boxes smashed by slipshod handling of ice. You can go away for a week, leave the house or apartment completely locked up, and yet find your butter, eggs, and cream in perfect condition when you return.

Several types of refrigerating plants for the average home now can be purchased at from \$275 up, depending, of course, on the size of the ice box. Or, if you already own a really good ice box, a refrigerating unit easily can be installed with a special tank taking the place of the usual chunk of ice.

One of the important advantages of the home refrigerating plant lies in the uniformly cold temperature maintained in every part of the box regardless of outside temperature. And the character of the atmosphere inside is also better for the preservation of food-stuffs because of the difference in the amount of moisture in the air. As ice melts, the air inside an ice box is extremely damp. With artificial refrigeration moisture is extracted from the air and collects in the form of frost on the surface of the cooling unit that is installed in the standard ice chamber.

ALL home refrigerating outfits operate on the same general principle. In fact, they are simply highly refined models in miniature of the huge machines used in the artificial ice manufacturing plants. An electric motor drives a pump that compresses the gaseous freezing agent, either sulphur dioxide or methyl chloride. These gases, compressed and cooled to ordinary room temperatures, become liquid, and when the pressure is gradually released in the cooling unit inside the ice box, they turn into gas again. In doing so, they absorb heat. In other words, they cool the tank in the ice chamber to below the freezing point of water.

This cycle is repeated over and over until the automatic control stops the motor when the temperature in the ice



A Complete Ice Making Plant

One of the new motor-operated refrigerators for small houses or apartments, that provide even, dry cold for food, and clean ice for beverages

box has been reduced sufficiently. The same control mechanism starts the motor again as soon as the ice box temperature rises to a predetermined point. The apparatus is automatic and requires no attention except oiling the electric motor at infrequent intervals. And even this small amount of attention has been eliminated by a new invention of two Swedish engineers.

"Turn on the ice!" may become a common household expression if this new invention works as well as ex-

periments seem to indicate it will. The housewife has only to turn an electric switch or light a gas flame to put it into operation. There are no moving parts. The proper amount of hydrogen, ammonia and water are in the hermetically sealed steel piping of the apparatus.

The heat from the electric heating element or the gas flame in the Swedish apparatus continuously drives off ammonia gas from the water in which it is absorbed in one compartment. The gaseous ammonia is liquefied by the cooling effect of water from the regular house supply flowing slowly through a cooling jacket. Then the ammonia turns into gas again in the cooling tank inside the ice box, where it mixes with the hydrogen gas and is drawn by gravity into another chamber where it is reabsorbed by the water. The water containing the ammonia is pumped by thermosyphon action into the first tank, and the process repeats itself as long as the heat is turned on.

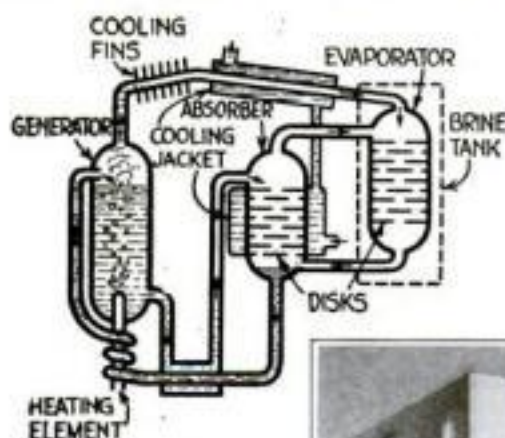
The cost of operation for any of the modern refrigerating systems depends, of course, on the size of your ice box, on the outside temperature, and on the care taken to see that the doors do not remain open longer than necessary. In many parts of the country, electric power for a home refrigerating plant can be obtained for five cents or less a kilowatt hour, and when current is obtainable at these low rates, you can keep your ice box cold by means of a home refrigerating plant for less than you would have to pay for ice.

BUT the great advantage of the apparatus is in the lack of attention required and the uniformly even cold maintained, which results in less food spoiled, together with the satisfaction of knowing that you are no longer dependent on messy icemen or any outside and possibly uncertain supply of ice.

But before you place an order for either a complete new refrigerator with an ice making apparatus built into it or simply the ice making machine to be applied to your own refrigerator, be sure that you investigate the standing of the concern manufacturing the outfit so that you can bank on adequate service if anything goes wrong.

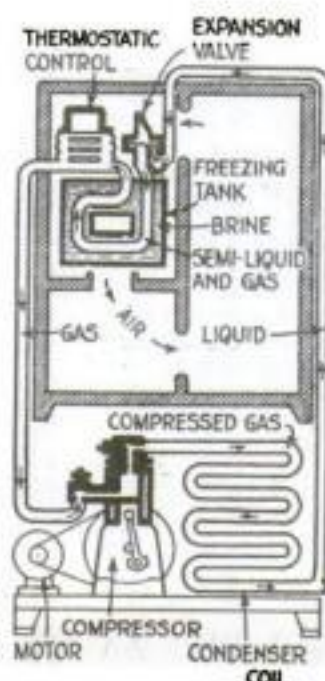
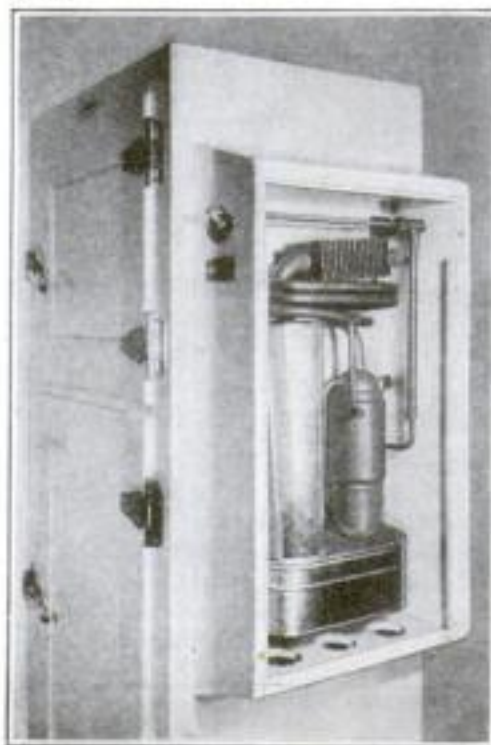
Compression Freezer

At the left is a diagram of the working parts of the electric refrigerator shown at the top of the page



A Novel Type

At the right is one of the latest types of electric refrigerating plants. Its parts are hermetically sealed, and it is operated by gas or electricity. Above is a diagram of its principal parts

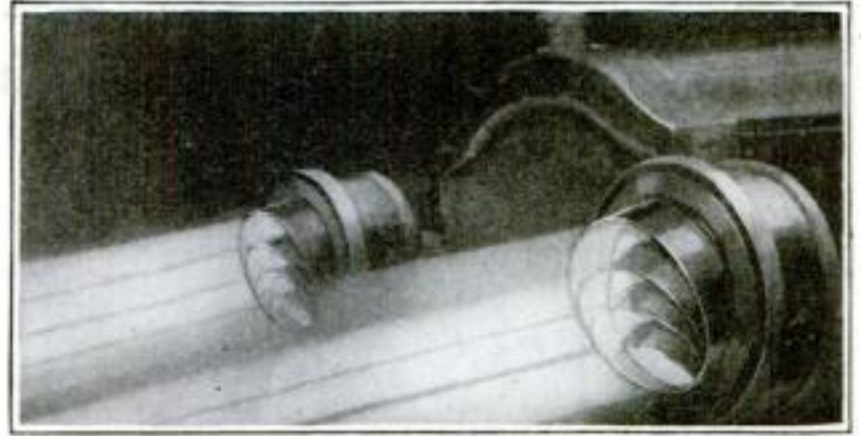


Useful Additions to Your Car



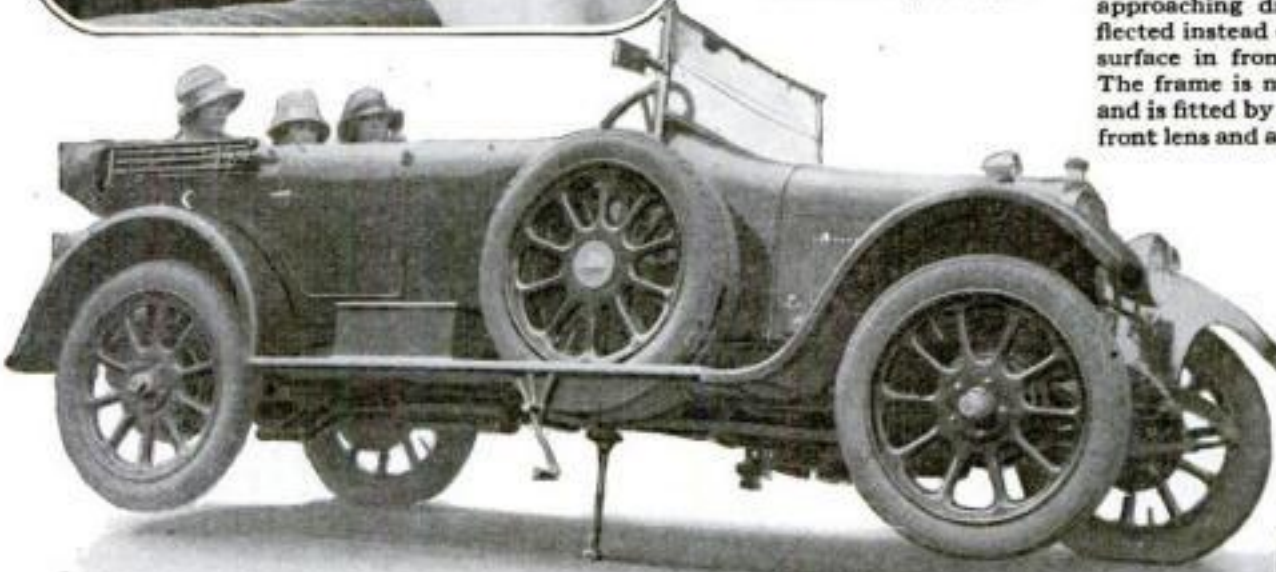
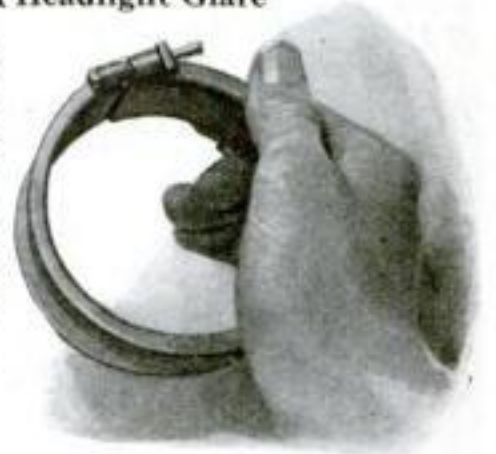
Shoulder Rests Promote Comfort

Because the average road is curved from side to side with the center higher than the sides, the passenger on the left side of the back seat is constantly slipping over toward the right side of the car. The strain produced by attempting to remain at the left end of the seat spoils the pleasure of motoring. These new shoulder rests (left) eliminate this trouble by keeping the left-hand passenger always in a very comfortable position.



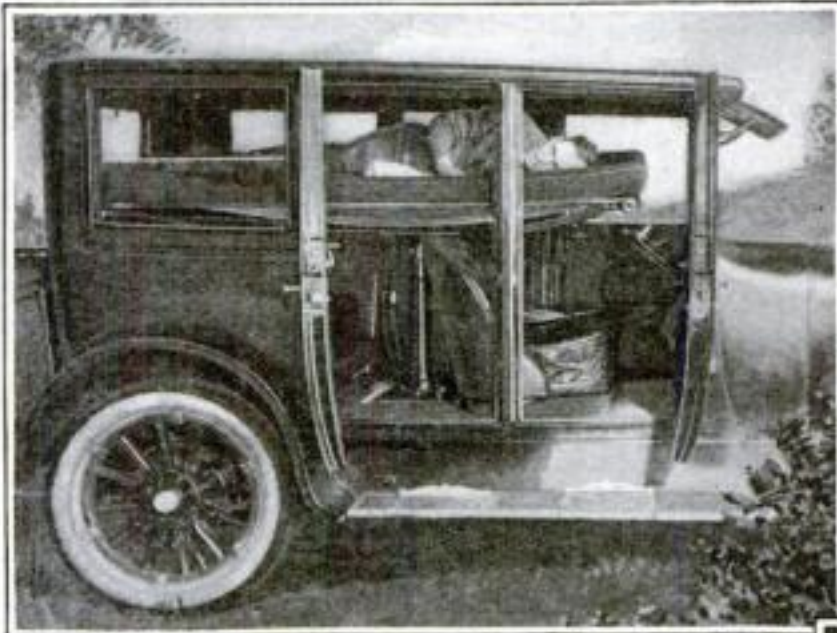
Novel Visors Cut Down Headlight Glare

This new anti-glare device consists of elliptical visors so arranged that the light rays which normally would be thrown into the eyes of the approaching driver are deflected instead onto the road surface in front of the car. The frame is made of metal and is fitted by removing the front lens and attaching clips.



New Rim Keeps Ford Fan Working

This simple rim is bolted on over the pulley on the Ford crankshaft. The rim is said to keep the belt from slipping off. It is easily applied.



Full-Length Bed for Auto Campers

Although this bed is made entirely of metal, it is arranged so that it folds up out of the way when not in use. Sagless springs are built into it. A unique feature is the method of support. A strong metal column is bolted to the floor boards back of the front seat. This column takes most of the weight.

Lifts Both Wheels

In order to eliminate the need for a separate jack and the difficulty of operating it against the back axle especially, an English firm has brought out a pair of jacks designed to be attached permanently to the car. The stem of the jack is threaded and the nut is geared to the handle so that a very low reduction allows the car to be lifted with little effort (above).



Bumper and Luggage Carrier

When folded up, this device looks like the ordinary full-length rear bumper, but it can be unfolded to carry extra luggage that would otherwise clutter up the tonneau and be in the way.

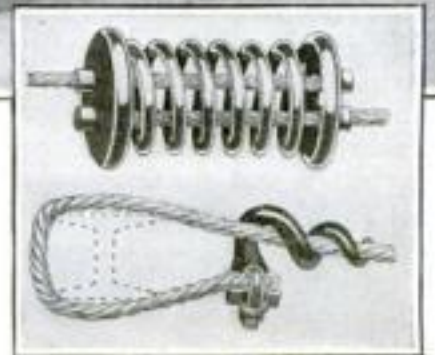
Auto Notebook

Salesmen, doctors, and real estate dealers will find this handy device useful for making memoranda or keeping addresses where they can be referred to while the car is in motion. Two removable spools with a strip of starched cloth are arranged within the compact case so that any portion of the cloth may be brought opposite the opening and locked in place.



Tow Line Has Spring Buffer

The spring buffer at the right incorporated in the tow line above prevents snapping the cable when the tow car takes up the slack in the line. Another feature is the peculiar shape of hook at each end of the line that permits quick attachment without tying knots, a big item in its favor.



How to Pick the BEST Car in Its Class

Gus Stresses Importance of Simplicity and Strength of Mechanism

By MARTIN BUNN



"ALL right, Henry," agreed Gus, "let her have the disk wheels if she thinks they're so classy. You can take the extra amount out of her allowance." "That's not fair," said Grace, pouting. "Get your old wood wheels if you think they're just as good."

"NOW," said Gus Wilson to his nephew, Henry, as they passed through the gate at the Milbury Auto Show, "the first thing for you and Grace to decide is how much you can afford to pay for a car. Then we'll see what looks like the best buy in that class."

Henry had just been handed another raise in salary and felt that at last he could afford to yield to his bride's pleading that he buy a car. He had persuaded his uncle and Joe Clark, proprietors of the Model Garage, to help him make a selection.

"And don't forget," warned Gus, "that buying your car on time gives you no excuse for spending too much for it."

"A thousand is about the limit," said Henry. "I'm sure I can swing that much."

"That means not over nine hundred for the list price," broke in Joe Clark, "because freight, taxes, license and the rest of the incidentals will certainly run it up to the thousand mark."

"I'd like to get one of those sporty-looking roadster types," said Henry a few moments later, as he gazed longingly at a flashy job finished in pale green with lots of nickel fittings.

"Why, Henry," chimed in his wife, "you promised me a sedan. I don't want a car that will hold only two people."

"GRACE is right, son," Gus said. "If you can have only one car, the best buy is a closed model, but I'd recommend a coach. You get a lot more for your money than you do in a sedan. Roadsters are all right for rich people who can afford to keep more than one car. I'll admit that it's a lot of fun to drive a fast roadster, but it's a nuisance when you want to take along some of your friends."

"And," continued Gus, "if you'll take my advice, you'll lay off any car that is painted in very light colors. Dust and the tar they put on the roads will make one of

those pale pink babies look like the dickens in short order. Stick to a dark blue or green unless you want to spend all your spare time washing it."

"I wouldn't give a fig for all the closed cars in the world," growled Henry peevishly.

"Then why not compromise on a touring car?" suggested Gus with a wink at Joe.

"Humph!" exclaimed Henry. "And have about a million curtains to put up

every time it rains! Nothing doing! If we don't get a roadster, we might as well go the limit and get a coach."

"I'm so glad that's settled at any rate," observed Grace. "Can't we get one of those eight-cylinder things? You know Agnes' husband bought her one, and it's just too smooth for anything!"

"There's the woman of it!" grunted Gus. "Always trying to keep up with the Jones's. You couldn't possibly get an eight-cylinder car for the price Henry mentioned. You can get a good six, though."

"SEEMS to me a four-cylinder car would be a lot easier to repair than a six," said Henry as they passed a shiny new four-cylinder model.

"You're dead right, son," stated Gus emphatically. "Just fifty percent less work when it comes to grinding valves or putting in new rings or tightening up connecting rod bearings. And it's a whole lot easier to locate trouble in a four-cylinder engine, too. There was a time when the four-cylinder cars were a whole lot rougher running than the sixes, but what with light pistons and good stiff crankshafts, the four-cylinder cars of today are pretty darn smooth. If you look at it from the standpoint of expense for repairs and the amount of work you will have to do yourself, the four-cylinder car is certainly the best bet."

"Outside of work on the motor itself, a light six won't require any more attention than a four. Changing tires or overhauling the rear end or anything like that is the same on both. Are you going to drive the car too, Grace?"

"You bet I'm going to drive!" said Grace emphatically.

"Then don't forget, Henry, that a six-cylinder car needs less gear shifting than a four. Grace would get along better with a six on that account. Whatever car you buy, though, (Continued on page 142)

Know Your Car

SHOCK absorbers or rebound snubbers properly applied and kept in good working order improve the riding of any automobile. The ideal shock absorber should permit free compression of the springs on a bump and then the friction mechanism should take hold immediately to prevent the usual jolt. The maximum shock absorbing effect is obtained only if absorbers or snubbers are designed for the car to which they are fitted or built so they can be adjusted to give proper friction.

To get the best riding comfort in driving, follow these rules:

1. Get high-grade shock absorbers and see that they are correctly adjusted.
2. Keep your springs well lubricated and protected from mud and grit by some form of covering.
3. See that your tires are pumped up to exactly the right pressure. Too much air makes the car hard riding, too little shortens the life of the tires.

**If you're
tired of
working
for
someone
else — —
here is your
Opportunity**



Be your OWN Boss

START right off in a specialized line of work that will give you steady profit, without dull seasons, without "lay-offs," and put you beyond any boss's whim. Go into **EXPERT FLOOR FINISHING**. Master overnight this well-paid trade, eagerly in demand everywhere today . . . because the service it offers is advertised monthly to millions! And competition won't worry you!

Many Earn \$15 to \$20 a Day

Men no abler than you get from \$2.50 an hour up for **WAX-POLISHING** floors by the Johnson Electric method, for which we fully equip you. And this big-paying work is **WAITING** for you right where you live, **NOW**. Every home, club, hotel, restaurant, almost every store, should have its floors and linoleum polished regularly. You can do it perfectly, be paid spot-cash for it, and never have to go home tired—for the machine does **ALL** the hard work.

JOHNSON'S WAX *Electric floor Polisher*

This wonderful, new, swift, easily-managed machine **BURNISHES ANY FLOOR** to a beautiful, gleaming lustre. It runs itself. You merely guide it along. You need not bend nor stoop nor strain to do a perfect job. Ten times quicker than hand-methods it **DEEP-WAXES** wood, linoleum, tile, marble and all other floor-surfaces to the finest polish imaginable.

Investment Less Than \$50

You get into this well-paid vocation for an outlay under \$50. This fits you out with the wonderful Johnson Electric Floor Polisher, a Lamb's-wool Mop for applying the wax and a generous supply of **JOHNSON'S LIQUID WAX**. You pay not one cent for the training which qualifies you as a Floor Expert. We contribute that **FREE OF ALL CHARGE** to you. And you are actually **SET UP IN BUSINESS IMMEDIATELY**, right in your own town.

Don't Delay

Act NOW

Just as a starter, send the coupon and get the details. It doesn't obligate you in the least and it may be the starting point of a big, successful, prosperous business of your own. Look into this!

Clip This Coupon Out and USE it

S. C. JOHNSON & SON, Dept. P.S. 5, RACINE, WIS.
"The Floor Finishing Authorities"

Please tell me how I can realize \$110.00 a week giving expert Johnson Electric Floor Waxing Service.

NAME

ADDRESS

CITY

STATE

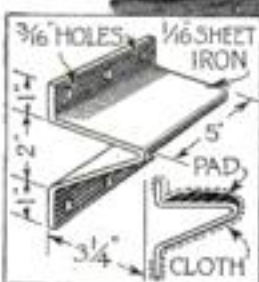
Newest Aids for the Autoist

An Arm Rest for Closed Cars, and Other Useful Ideas

WHILE the driver of a touring car or runabout usually finds that the side of the body is low enough so that he can rest his left arm comfortably along the edge of the body beside the seat, the owner of a closed car is not so fortunate, especially when the window is partly closed in cold weather. A simple arm rest can be constructed out of sheet metal and screwed to the side of the body at a convenient height. Figs. 1 and 2 show a typical example. The galvanized or sheet iron framework is covered with upholstery fabric to match the interior trim of the car. On long drives, an arm rest of this type will add greatly to the comfort of the driver. Fairly heavy padding is desirable to promote comfort.

IN SOME makes of cars, the choker rod is fitted with a spring to pull it back into position when the knob is released. This construction is used to make it impossible for the motorist to forget to throw off the choker after the motor is warmed up, but it is a nuisance in very cold weather when it is necessary to hold the choker out for some time because the motor heats up so slowly. A piece of sheet iron bent up and slotted as shown in Fig. 3 will eliminate this trouble. The motorist will have to bend and shape the device to suit the construction of his own choker-rod, and it will be a good idea to fix it so that it will hold the choker in approximately the position required for warming up rather than for starting. In order to make sure that the device will always be handy when needed, get in the habit of tucking it down at the end of the seat cushion when not in use.

WITH many of the oil-regulating types of piston rings, it is necessary to drill holes in the piston ring slots to allow the excess oil that is scraped off the cylinder walls to flow back into the crankcase by way of holes through the pistons. Great care must be taken in drilling these holes to make sure that they are spaced properly and that the drill does not cut into the side of the slot and cause the gas to leak past the piston rings. A simple way to avoid these difficulties is to make a drill jig out of a piece of one of the old piston rings. Fig. 4 shows how this



Figs. 1 and 2. A convenient arm rest for a closed car. Fig. 2 shows its simple construction at a glance.

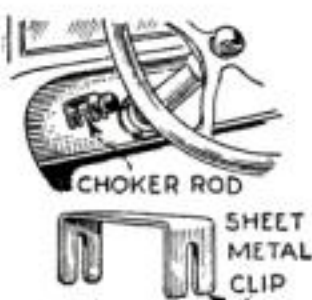


Fig. 3. A piece of sheet iron bent and slotted makes handy choker rod holder.

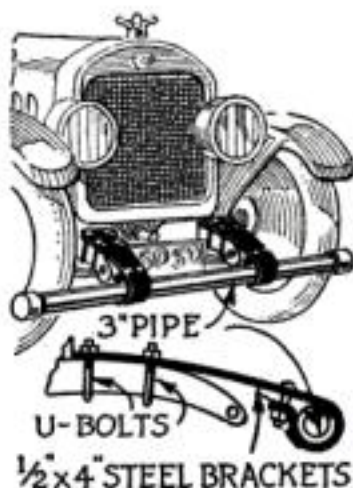


Fig. 5. A homemade bumper can be constructed from a three-inch iron pipe and pieces of heavy strap iron.

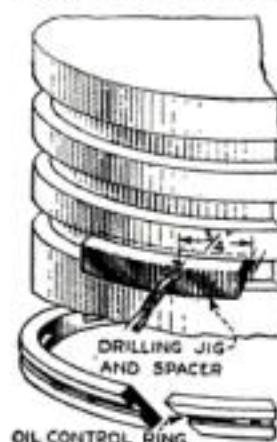


Fig. 4. To prevent cutting into piston ring slots, use a drill jig made from an old ring.

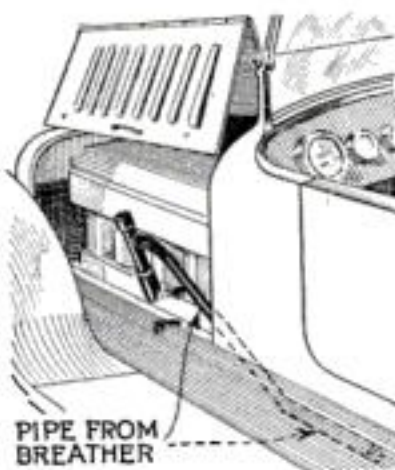


Fig. 6. A branch from the breather pipe run back under the car will divert the noxious breather fumes to rear of car.

strap iron, some U-bolts, and a section of three-inch iron pipe with caps screwed on the ends. A coat of enamel can be applied to match the car or the bumper bar can be nickel plated.

ONE source of discomfort in the closed motor car that is annoying and unhealthy is the burnt gas that gets into the body from the breather pipe by way of the pedal slots and the other openings in the floor boards and dash. Even in a motor that is in perfect working order, more or less of the exploding gas leaks past the piston rings into the crankcase. The breather pipe in the crankcase allows this escaped gas to flow out of the crankcase, otherwise the accumulated pressure would cause loss of power and considerable oil leakage. One simple way to get rid of these noxious gases is to fit a tight cap over the top of the breather pipe and also fit a branch pipe that is run back far enough under the body so that the gases will be discharged to the rear of the car, as shown in Fig. 6. The size of pipe is not important, although it is not a good idea to use smaller than $\frac{1}{4}$ -inch inside diameter. Copper tubing will do very nicely.

UNDoubtedly a large number of cylinder head bolts are stripped each year simply because the hole in the cylinder block into which the bolts were screwed filled up with carbon when the tops of the pistons were scraped and the extra force applied in an attempt to force the bolts up tight proved too much for the threads. It is a mighty good idea to insert the bolts loosely in the holes nearest the piston being scraped, but if carbon does get into them, it can be removed very easily by screwing a tire pump hose to a spare valve stem and blowing the carbon out of the holes. The end of the valve stem that goes inside the tube is made regularly with a small hole that will do nicely as a nozzle. The flange can be sawed off, if desired, as shown in Fig. 7. Use a pointed instrument to loosen up the carbon if it caked hard.

LINING up the hole in the spring bushing with holes in the shackle is no simple job. Frequently the

threads of the shackle bolt are battered in forcing it into place. A simple remedy is a pointed cap nut in place of the regular shackle bolt nut, which can be driven into place with a hammer. (Fig. 8). An ordinary nut can be filed this shape.

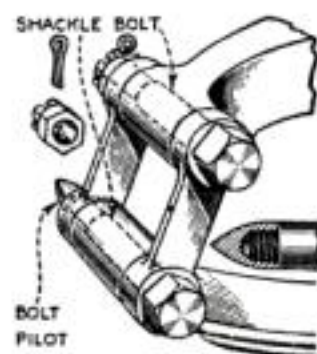


Fig. 8. A pointed cap nut simplifies task of getting spring bushing and shackle holes together for the bolt.

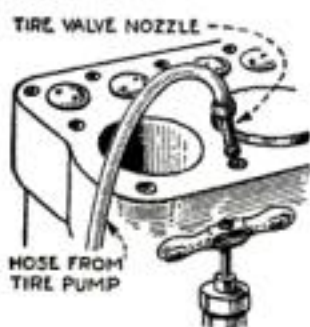


Fig. 7. A tire pump will prove useful in cleaning out bolt holes that have become filled with carbon.

can be done. Drill the hole in the piece of old piston ring a trifle larger than ordinarily.

A SIMPLE way to make a satisfactory bumper for your car is shown in Fig. 5. It consists of two brackets made of heavy

Ten Dollars for an Idea!

CHARLES S. JONES, of Philadelphia, Pa., wins the \$10 prize this month for his homemade bumper, which is shown in Fig. 5.

Each month **POPULAR SCIENCE MONTHLY** awards \$10 in addition to regular space rates for the best idea for motorists. Other published contributions will be paid for at usual rates.



Genasco Latite Shingles

The greatest problem in the manufacture
of asphalt products solved by

Tycos Instruments

Says M. S. Darrow, Manager
Barber Asphalt Co., Madison Plant, Madison, Ill.

"Keeping our materials at the proper temperature—the greatest problem in the manufacture of asphalt products—has been easy since we installed *Tycos* Index and Recording Thermometers throughout our plant in 1916. We are the largest manufacturers in the world of asphalt products, especially roofing.

"In making roofing we combine several different asphalt materials at the high melting point of 350°F. Air passed through causes oxidation; and the higher the temperature and the faster the air goes through, the quicker the oxidation. However, the air sets up a chemical reaction which produces additional heat, and if this is not controlled we have an explosion. In regulating the fires under our 19 converters, we rely upon 19 Taylor thermometers.

"The four saturating tanks, in which roofing felt is impregnated with asphalt from the converters, must be kept at a temperature of 360-400°F. A *Tycos* recording thermometer on each gives us an accurate check and record. The saturating tanks are heated to the proper temperature by circulating heated oil around them. On each of three absorbers we have double registering *Tycos* recording both outgoing and incoming temperatures.

"Four flue gas thermometers show whether we are operating at an efficient temperature. The proper temperature for our boiler feed water is indicated by a Taylor. Some 30 other Taylors are used as testing thermometers, in laboratories, etc.

"We have used other makes of thermometers, but none are as satisfactory as *Tycos*. On our converters we can go to within 5° of the flash point and feel safe with *Tycos*.

TO MANUFACTURERS

If your manufacturing processes require the indicating, recording or controlling of Temperature, there is a type and style of instruments in the *Tycos* Line of 8000 varieties that will help you. Informative literature on any type of instrument will be sent you promptly on request, or our engineer will consult with you on the application of *Tycos* to your particular manufacturing problem.

Taylor Instrument Companies

Main Office and Factory
ROCHESTER, N. Y. U. S. A.
Canadian Plant: *Tycos* BUILDING, TORONTO
SHORT & MASON, Ltd., Manufacturing Distributors in Great Britain



Tycos for the Home

Tycos Office Thermometers

An aid in promoting human efficiency.

Tycos Bath Thermometers

To enable you to get the most good from your bath.

Tycos Wall Thermometer

To help you to maintain a temperature in your house conducive to good health.

Tycos Quality Compasses

To show you the right way in unfamiliar country.

Tycos Hygrometer

To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos Home Set

Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Fever Thermometers

A necessity in every home.

Tycos Stormoguide

Forecasts the weather twenty-four hours ahead with dependable accuracy.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above



Tycos

for the Medical Profession

Sphygmomanometer, Pocket & Office types
Fever Thermometers, Urinalysis Glassware

Bulletin on Request

THE SIXTH SENSE OF INDUSTRY
Tycos Temperature Instruments
INDICATING • RECORDING • CONTROLLING



KRAEUTER & CO.



When You Need Pliers You Need Them Badly

Sooner or later, every man wants
a REAL pair of pliers

YOU may need them for anything from fixing your car to making radio connections—but when you *do* need pliers, you want the best.

Kraeuter Pliers are drop-forged from the best quality steel; and they are heat treated so accurately that the teeth will neither break-down from over hardness, nor mash down from softness. "Ask any Mechanic."

They stay sharp, bite hard, and hang on—instead of slipping, and wearing away the surface of everything you try to grip. The cutters are scientifically hardened and ground. They cut easily, and stand the hardest use.

Over 120 different styles and sizes—each the best of its kind.

On sale wherever good tools are sold

KRAEUTER PLIERS

"Ask any Mechanic"



Get Yourself a Kraeuter Wrench too.
Made to withstand hard usage. Light,
handy and handsome. No. A1618. 45¢



Needle Nose
Side Cutting
Pliers
No. 1661
6 in. \$1.75



Slip Joint
Combination
Pliers
No. 356
5 1/2 in. 80¢



Slip Joint
Combination
Pliers
With SIDE
CUTTERS
No. 1973
7 in. \$1.60



Electricians'
Side Cutting Pliers
No. 1831
7 inches. \$1.40

KRAEUTER Pliers & Tools

The Home Workshop

A Rotating Harrow Lightens the Work of Gardening

FOR garden patches where the space does not permit the operation of horse-drawn implements, the leveling and smoothing of the ground in preparing a seed bed usually has to be done with a garden rake—a slow and tedious job. A practical tool for performing this work may be made from an old auto or truck casing, four pounds of 30-penny spikes, a



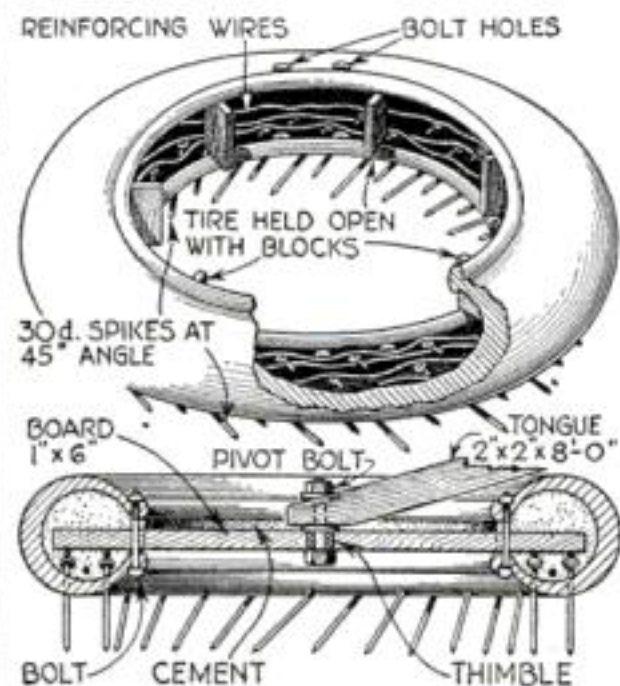
The harrow rotates as it is pulled

bolt, some cement and sand, and two pieces of timber.

The size of the casing to use depends on the strength of the operator or the power that may be available. One 30 by 3½ in. will make a one-man tool.

Hold the casing open with sticks or blocks and drive the 30-penny spikes through as shown at about a 45-deg. angle, staggered 4 in. apart. Allow the heads of the spikes to remain ½ in. above the inner surface of the casing. Bind the heads with a few pieces of wire to serve as reinforcement for the cement.

Before pouring the cement into the casing, fasten a 1 by 6 in. board across with four bolts, as indicated. Mix one part of cement and three parts coarse



Large spikes are driven through an old auto casing, which is then filled with concrete

sand or gravel and pour into the casing. Allow the cement to set for several days.

A 1-in. hole then is bored through the board at the center of the casing; a thimble cut from a ¾-in. pipe, 1 in. long, is provided; and the tongue or pulling arm, 2 by 2 in. by 8 ft., is pivoted in place with a ¾-in. (Continued on page 85)

BUILDERS

TRADE GUIDES

Audels Builders Guides are fully illustrated—easy to read and understand. Each set is a Good Trade Course for the apprentice—and a Good Reference for journeyman and master. Use coupon below for free examination.

Audels Carpenters and Builders Guides—4 vols. \$6

Inside information, illustrated, for Carpenters, Builders, Joiners, Building Mechanics. 1600 pages; 3700 diagrams; flexible; pocket size. Short cut instructions, new methods, ideas, solutions, plans, systems—money saving suggestions. An easy progressive course for the apprentice. A practical daily helper and Quick Reference for the master worker. A Helping Hand to Easier and Better Work and Better Pay. To get this aid for yourself, simply fill in and mail the FREE COUPON below.



INSIDE TRADE INFORMATION ON:

Tools of The Trade—How to Use The Steel Square—Saw Filing—Joinery—How to Make Furniture—Carpenters and Builders Arithmetic—How to Read and Draw Plans—Specifications—How to Figure Jobs—House and Roof Framing—How to Lay Out Work—Foundations—Doors and Windows—Stairs—Millwork—How to Paint—and hundreds of other subjects, covering the entire trade with pictures and explanations all easy to read and understand.

"Audels Carpenters and Builders Guides are just what every man needs who follows the building trade. He can learn more from your books than he would get a chance to learn in two years work."—J. A. Manning, Lockport, N. Y.

Audels Plumbers and Steamfitters Guides—4 vols. \$6

A new set—just out! A practical, illustrated, Reference Library and Study-Course for Master Plumbers, Journeymen and Apprentice Steamfitters, Gas Fitters and Helpers, Sheet Metal Workers, Draughtsmen, Master Builders, Engineers and all Building Trade Students. 1670 pages; 3642 diagrams; flexible; pocket size. Guide explains all the principles, advances and short cuts of the Plumbing and Heating trade. Contains instructions on how to figure and estimate jobs. Use FREE coupon below to examine, without obligation, this valuable work.



INSIDE TRADE INFORMATION ON:

Plumbers Code—Physics—Materials and Tools of The Trade—Lead Work—Water Supply—Drainage—Rough Work—How to make Tests—How to Figure Jobs—Pipe Fitting and Bending—Heating—Ventilation—Refrigeration—Gas—Steam—Sheet Metal Work—Smithing—Brazing—Motors, and hundreds of other subjects covering the plumbing trade. Each point clearly explained in text and pictures that you can easily understand.

"Audels Guides are practical, easy to understand, and can be relied upon. They cover the entire field in plain language."—W. F. Arminger, Annapolis, Md.

Audels Masons and Builders Guides—4 vols. \$6

A new, complete, illustrated trade reference library, for Bricklayers, Cement Workers, Plasterers, Tile Setters and Stone Masons, including a practical outline of Steel Construction. 1100 pages; 2067 diagrams; flexible; pocket size. A practical Trade Assistant explaining modern methods of masonry construction. Easy to understand and apply. A reliable and authentic reference work and study-course for Master Journeyman and Young Mechanic. Use FREE COUPON below and find out for yourself, without obligation, whether this set will benefit you.



INSIDE TRADE INFORMATION ON:

Brick Work—How to Lay Brick—Various Bonds and Designs—Brick Foundations—Arches—How to Set Tile—How to Figure Jobs—Concrete Work—Mixing—How to Place Forms—Reinforced Work—Stucco—How to Plaster on Different Surfaces—Stone Masonry—How to Read Blue Prints—Complete Outline of Steel Construction—and hundreds of other subjects with diagrams, pictures, text—easy to read and understand. "Audels Masons Guides are the best books to be had on the subject."—H. A. Sonnet, Corliss Sta., Pa.

Audels Handy Book of Electricity—1 vol. \$4

Audels Handy Book of Practical Electricity, illustrated, is a Ready Reference and Study Course in one pocket-size, leather bound book. Every engineer, electrician, mechanic and student will find in this up-to-date Guide the KEY to a practical understanding of Electricity. 1040 pages; 2600 diagrams. A reliable authority and Helper—easy to understand.



INSIDE TRADE INFORMATION:

The entire electrical field is covered in this one volume. Here are some of the chapter headings:

Wiring Diagrams—Calculations—Machine Sketches—Maintenance and Repair—Radio—Armature Winding—Power Wiring—Storage Batteries—A. C. Motors and Wiring—D. C. Motors and Wiring—Telephone—Telegraph—Ignition—Generators—with Ready Reference Index which gives a quick answer to every problem.

To Earn More—Learn More

Your Big Opportunity for Advancement
Be a GOOD mechanic. It's more satisfying. It insures you against unemployment. Learn all about your trade by easy reading of these Builders Guides.

OUR GUARANTEE

Examine any book published by us without charge. If you like it, keep it. If not, send it back. Pay us only if you are satisfied. No charge if you are not.

THEO. AUDEL & CO.
65 W. 23rd St., NEW YORK, N. Y.

FREE EXAMINATION COUPON

THEO. AUDEL & CO.
65 W. 23rd St., NEW YORK CITY
Please mail me for free examination the books marked (x) below. If I find them satisfactory, I agree to mail \$1 in 7 days, on each set ordered, and to further mail \$1 monthly on each set until I have paid the purchase price.

☐ 4 CARPENTERS GUIDES \$6 ☐ 4 PLUMBERS GUIDES \$6
☐ 4 MASONS GUIDES \$6 ☐ 1 ELECTRICIANS HANDY BOOK \$4

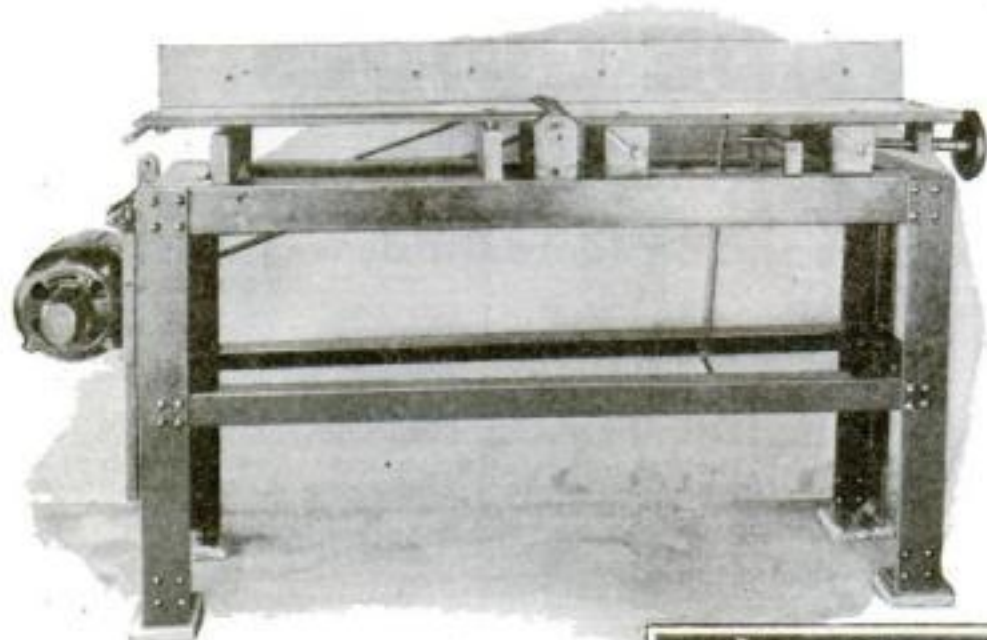
NAME.....
ADDRESS.....
OCCUPATION.....
EMPLOYED BY..... 5T34

I Wanted a Hand Planing Machine

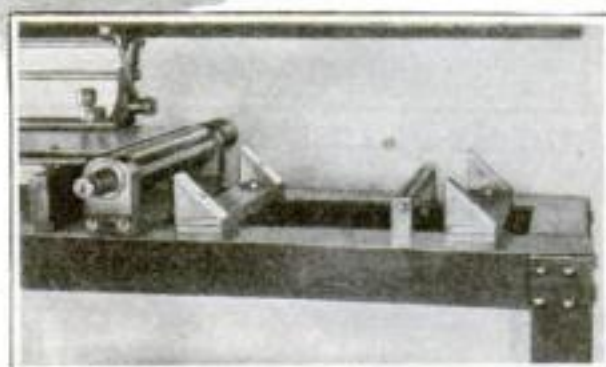
So I Made One—It Has Easy Running Ball Bearings, and It Cost Me Very Little to Build

By RAY F. KUNS,

Principal Automotive Trades School, Cincinnati, O.



Materials for this jointer can be obtained easily. The ball bearings are from a junked auto. Note the cutter head and the adjusting ways for the forward table in the view below



THIS jointer, or hand planer, as it is often called, was first designed for use in a home workshop. It was so efficient that a second one was constructed on the same plan for use in a school shop.

While it is not designed to carry a heavy, continuous load, each of these machines is reasonably accurate and on occasion will surface the face of a 10-in. board. The same general plan might be followed for a machine for lighter service. To run out a machine for heavy service, the head would have to be made more substantial and the size of the motor increased.

In most cities, a half-horsepower electric motor is about as large as is permissible on the regular lighting circuit. That is the size used in this instance. The speed of the head is held to about 3500 revolutions a minute. A 2-in. belt is used to drive the jointer. The motor is mounted directly on the machine and the adjustment on the glued belt is made by sliding the motor down in slots provided for that purpose in the board used for mounting the motor.

Equal-leg angle irons, $\frac{1}{4}$ by 3 in., are used for the legs and for the top of the frame supporting the head and the tables. The braces E are made from $\frac{1}{4}$ by 2-in. angle iron.

The frames made up from the parts J, M and E are first put together. If the shop is equipped to do welding, the corners are welded.

The legs K next are worked to size and riveted to the two frames. Welding could be resorted to instead of riveting for this work, but the danger of the parts being warped out of square is considerable.

Plates made from short lengths of the 3-in. angle iron are riveted into the lower corners of the legs to make feet, and they serve as anchors for fastening the machine to

the floor. One-half inch holes are drilled for the lag screws or bolts before fastening these feet in place.

Particular care should be used to see that the top of the frame is fairly level, otherwise trouble will be experienced in fitting the tables and head to it.

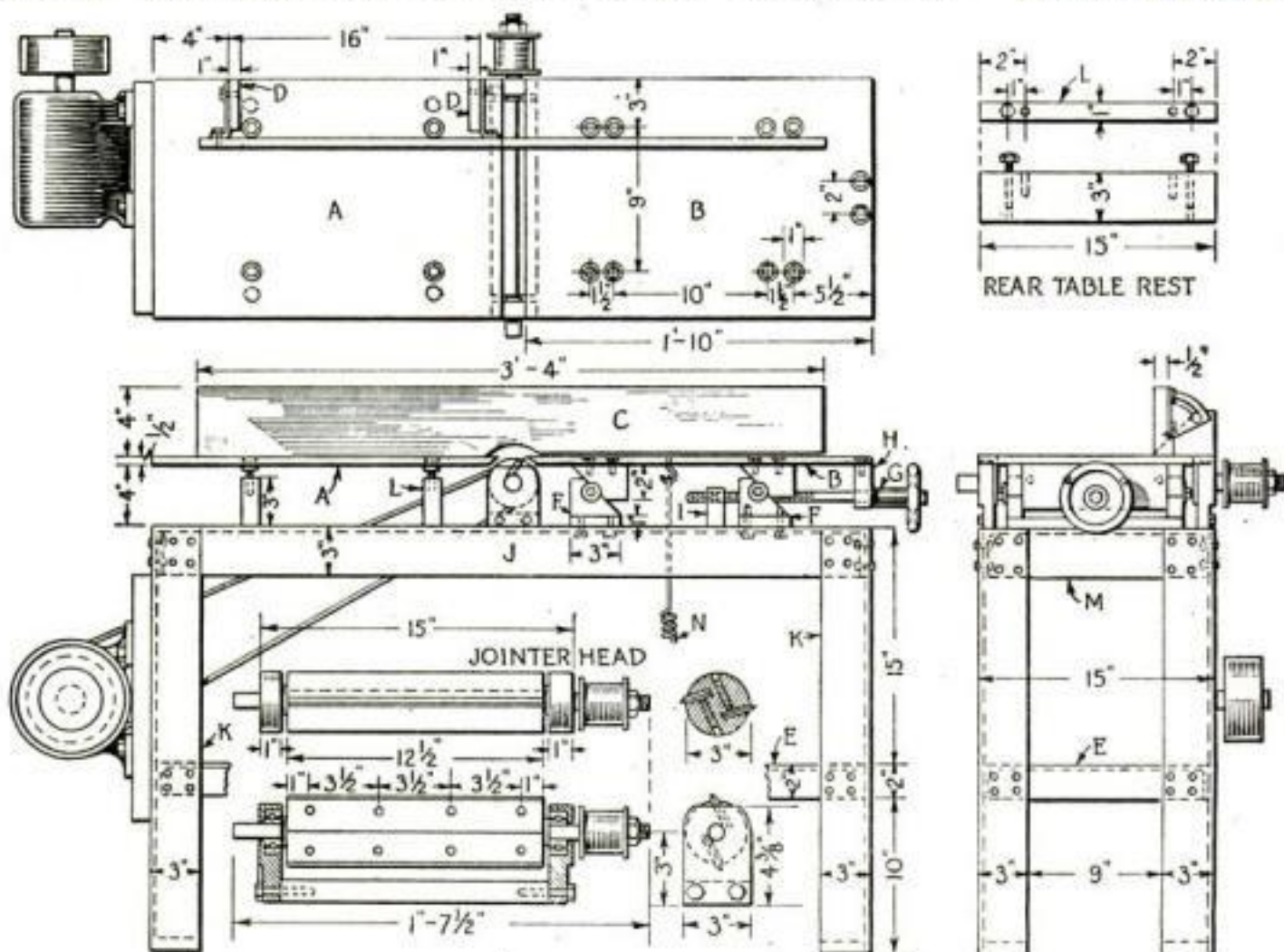
With the frame in good condition, the work on the tables and the head may proceed. It will be noted that a good part of the head frame and table sup-

ports is made from 1 by 3-in. cold rolled steel. The rear table rests L are two 15-in. lengths of this material. Cap screws fasten them to the frame.

Inasmuch as the rear table does not require a great deal of adjusting, the plan of allowing the table to rest on four cap screws was adopted. These screws may be turned to any necessary height; then the table is laid in place and clamped securely by means of the other cap screws arranged to come just 1 in. inside each of the first four on which the table is resting. All cap screws used to fasten the tables are $\frac{3}{16}$ -in., and have the tops of the heads dressed off until they are nested in countersunk holes.

The rear table could be adjusted more conveniently if it were provided with sliding ways as is the front. That is optional with the builder.

The front table must be provided with easy means of adjusting the depth of the cut. To avoid complications, blocks of cold rolled bar are cut as indicated at F. The cut is at 45 degrees. In order to prevent the ways that are screwed to the forward table from slipping off their companion ways bolted to the frame, a cap screw and washer arrangement is used. Each of the four lower ways is drilled and tapped as near to the 45 degree edge as possible *(Continued on page 93)*



Top, front and end views of the jointer and details of the rear table rest and the cutter head. The cutters are made from strips of tool steel. The same general design can be followed for a lighter machine

Own a Typewriter!

A Bargain You Can't Ignore!
Try It Free, and See!



GET YOUR typewriter now. A genuine Shipman-Ward rebuilt Underwood is the one you want — "the machine you will eventually buy!" Everyone needs it; now anyone can afford it. Don't send a cent—but do get our big special offer—our valuable book on typewriters and typewriting—free.

You can learn to write on this standard-keyboard machine in one day. A week after the expressman has brought it, you'd feel *lost* without it. A trial will *prove* it—and doesn't cost you a penny!

A New Plan

Our rebuilt plan gives you the *best* machine and saves you a *lot* of money.

The Underwood is so famous a make, and No. 5 so popular a model, you'll have to speak up if you want one of the lot we are just completing now!

We rebuild from top to bottom; *replace every single worn part*; each machine is in *sparkling* condition. New typewriters are commonly guaranteed for a year; we guarantee these completely rebuilt Underwoods *five years*. That's our Better-Than-New Guarantee! And we guarantee a big saving in money!

We don't ask for a cent now. Nor any money at all, unless you are completely won by the wonderful writing machine we ship you for an unrestricted 10-day free trial. When you do buy, take advantage of our very liberal scale of monthly payments. A host of our patrons have paid for their typewriters out of money made typing work for others. (One woman made a *thousand dollars* at home last year with her Underwood.)

If you know typewriters, you know the perfect work and the ease and speed of an Underwood. If you



This is a
Genuine
UNDERWOOD

The ace of
All Writing
Machines!

Act NOW If Ever!

have never owned a typewriter, start with the finest! One that will last you all your life! But, the time to act is NOW. Don't miss out on this present bargain offer. Don't do longer without the convenience of a typewriter.

Free Trial Offer

Our plan gives you the opportunity of a *thorough trial* before you buy. You run no risk whatever. You start to pay for your typewriter *after* you have found it the one and only machine for you! But get the facts before this lot of machines is all in use. Clip the information coupon before you turn the page. It will pay you! Note the very useful book you will receive free! Write for full particulars at once.

Get our catalog that tells how we rebuild these wonderful Underwood typewriters in the largest factory of its kind in the world, and lowest prices and terms in existence. We will also include free, the new Type Writing Manual—it gives many examples and samples of uses for your typewriter; in business accounts,

social correspondence, recipes, shopping lists, household accounts, etc.; school work; literary work, etc. Clip coupon now!

FREE!



Mail to SHIPMAN-WARD MFG. COMPANY
2145 Shipman Building, Chicago

Please send me full offer, with Type Writing Manual FREE, prices, terms, etc., and full information about your FREE course in Touch Typewriting. All without obligation; this is NOT an order!

Name _____

St. or R. F. D. _____

F. O. _____ State _____

Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Repairs a Machine Bed

How to Draw Broken Parts Together with Red-Hot Keys

OLD BILL, standing in front of the shop watching the traffic go by, thought the day, with the first real marks of spring in the air, was glorious. It was wonderful to have a moment of leisure to look at the people driving by, and to see the first sprouts of green on a tree down the street.

Even so energetic a man as Old Bill seems to feel a certain lassitude in the spring sunshine, and he reveled in the thought that he had nothing in particular to do on such a delightful morning.

"You are wanted on the phone," came a call from inside—a pin to burst his bubble of reverie. He went into the office.

"This is he," he said into the transmitter. "Yes, I can come right away."

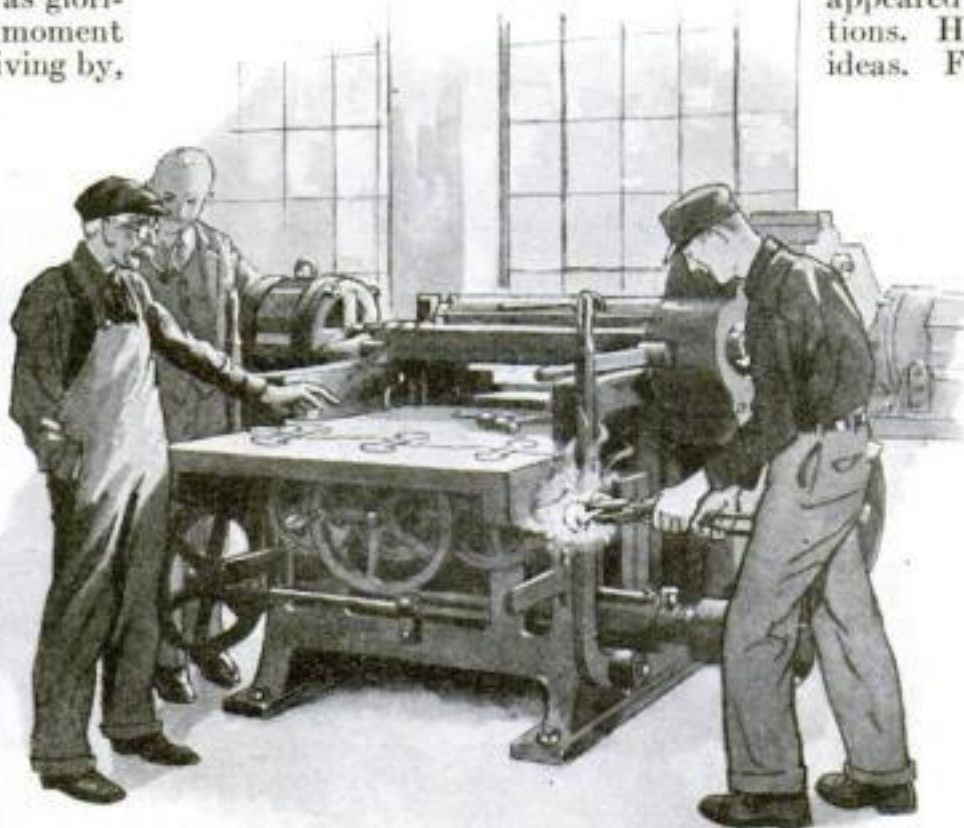
The smile that passed with the summons was back, or, rather, another smile took its place. Before, he had been glad just to be living; now he was happy because he was again in his element. He straightened the shoulders that had carried so many burdens—straightened them to receive another; and, once more the efficient man of machinery, he walked briskly through the shop before getting his flivver for a short trip to a furniture factory on the edge of the town.

Modern industry demands machinery that will perform superhuman tasks. To this end designers and inventors have gathered machine elements together into a compact and complicated mass that they call an automatic machine. Almost human, an automatic machine! With many tools hogging, snarling, ripping and boring their way into the work at the same time! Moving parts that start, carry and stop with the delicacy and precision of human fingers! Gigantic frames that stand firm as granite!

IT WAS such a machine Old Bill had been called to doctor. A 20-ft. length of line shaft had been dropped on it and had cracked the bed.

To Old Bill's eye, the gathering around the machine had the semblance of a family gazing at the ruin of a home destroyed by fire. The whole factory force, with the possible exception of the fireman, was standing around the crippled machine. The accident had stopped production

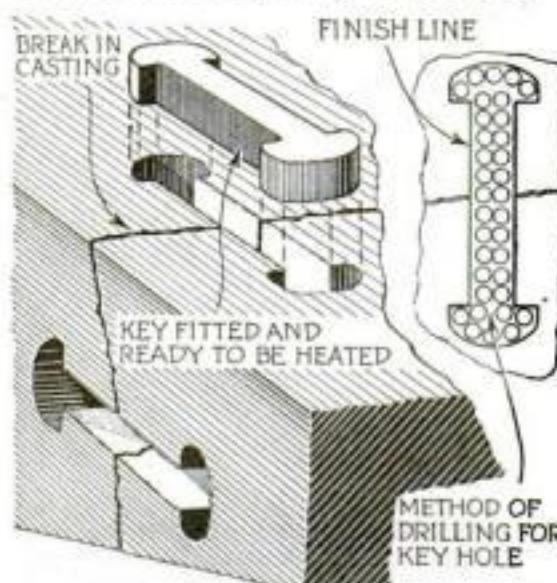
By JAMES ELLIS
Machine Shop Superintendent



Old Bill supervised the placing of the heated steel keys, which pulled the two parts of the cracked table firmly together as the keys cooled and shrank

entirely for, as is often the case, the one machine played a part in everything that went through the plant.

These things did not tarry long in Old Bill's mind. He was studying the damage. A big overhanging section of the frame had been broken off. The casting was about an inch thick and formed a sort of extension of the main bed of the machine, and carried two spindles. The operators had taken off everything removable.



An electric drill and chipping chisels were used in preparing the T-slots for the keys

"Could you weld it?" the president of the company asked.

Old Bill slowly shook his head. He appeared not to hear several other questions. He was ransacking his mind for ideas. First he looked at the top of the break, and at the bottom; then stood off and looked at the sides. Finally he said: "Get it cleaned up, and I will be back in a little while."

"What are you going to do, and how long will it take?"

"Fix it—and by tomorrow morning," Old Bill replied, and grinned.

THE head of the firm started to speak, thought better of it, and shook his head doubtfully as Old Bill hurried out of the plant.

The ruts in the road seemed but creases in velvet to Old Bill as he drove the flivver to the shop. Only long training in driving enabled him to dodge the cars that darted in front. His mind was on something else.

In the shop he sought Bob Laten first and told him to gather up some tools. Then he went to the blacksmith shop and drew a little sketch.

"Leave some stock so that we can machine these keys to fit," he said, and hurried off to find Laten with the tools in a bag and an electric drill beside it.

At the plant, Old Bill and Bob Laten began to lay off some holes. The apprentice whom they had brought along connected the drill. In a few minutes chips were flying.

Old Bill's method of repairing the break was apparent to the factory superintendent, who stood beside the president.

"He is going to cut tee slots in the edges of the broken casting," he said, "and then shrink keys in to hold the parts together. The same way that the flywheel on our engine is made."

"Will it be strong?" the president asked.

"Just about as strong as anything else could be," Old Bill said, as he stood back and watched the work. "It is the best thing to do in" (Continued on page 108)

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 102 to 112.



Use this and save your skin

"See that universal joint in the head of the scraper? It certainly beats tying rags on a flock of sore knuckles."



*Floor, Bench and
Cabinet Scraper
No. 181*

A turn of the handle locks the blade of a Starrett Scraper at any desired angle. It's about the handiest tool for tight corners you ever picked up. Has eight sharp edges—any of 'em can be put into action in an instant—a comfortable hand rest and a hardwood ball and handle. If you've been using an ordinary scraper ask your dealer to show you a Starrett—and you'll see the difference.

Write us for free copy of catalog No. 23 "W"

THE L. S. STARRETT CO.

*World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy*
ATHOL, MASS.

9030



Use Starrett Tools



"Be sure you send us STAR HACK SAW BLADES

We know what they'll do"

The shop foreman will never buy any other hack saw blade when he can save great waste from breakage by the use of Star Special Flexible Blades.

Star blades have been recognized for their superior qualities for a great many years, and this new blade is the supreme achievement of the oldest hack saw makers.

WRITE FOR FREE
SAMPLE BLADES

Clemson Bros., Inc.
Middletown, N. Y.

MAKERS SINCE 1883

STAR HACK SAWS



The Home Workshop

We Overhaul Our Lawnmower and Make It Cut Like New

By LAWRENCE B. ROBBINS

A SMOOTH RUNNING, clean cutting lawnmower gives zest to trimming the lawn, just as a freshly stropped razor does to shaving. It makes you feel like clipping the grass, instead of looking on it as merely another job.

Ordinarily, the lawnmower is a much abused implement. It is sometimes a wonder that it goes at all. Dust and dead grass frequently choke the bearings; the blades are dulled and nicked by stones, tin cans and pieces of wire; and even

the handle wobbles on its trunnions. Well, let's give it a real overhauling this year and make the lawn cutting game a joy instead of a task.

First, let's give it a bath of kerosene by taking off each wheel and washing out every bearing with an old brush saturated with kerosene. Now you can see the parts of the machine.

The blades are supported on a frame called the cylinder. This runs on two cone bearings, one at each

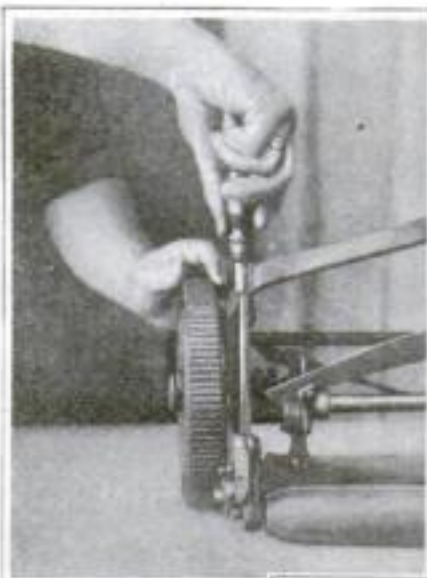
(Continued on page 79)



First thoroughly clean the lawnmower, especially bearings and movable parts, with kerosene and a stiff bristle brush



If revolving blades are too loose, the bearings at each end should be tightened, but not too much

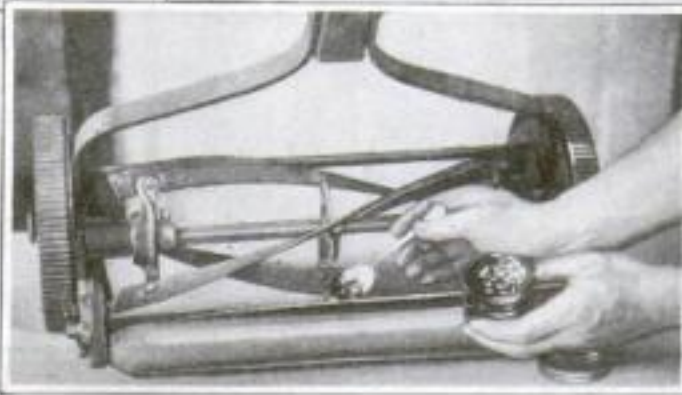


The stationary blade next should be adjusted (above) so that each revolving blade will just touch it. This is usually accomplished by loosening one screw a fraction of a turn and tightening another one alongside it a similar degree



The internal or pinion shaft and other parts should be well greased (above)

Carborundum and oil or a valve-grinding compound is smeared over stationary blade (at left) as the first step in sharpening



The Home Workshop

We Overhaul Our Lawnmower

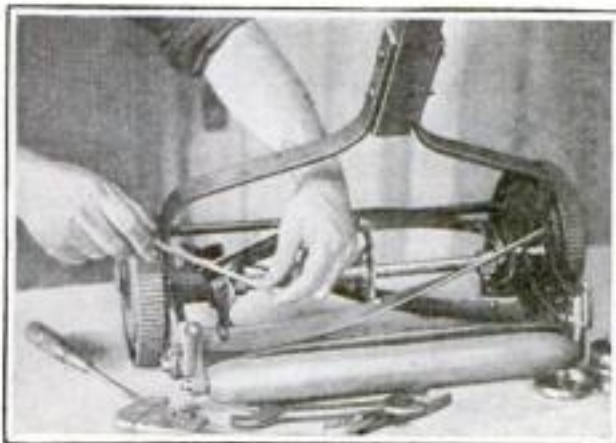
(Continued from page 78)

end, and should turn just freely enough to revolve without any play. To take up any looseness, turn up or down the two setscrews found at each end of the cylinder, or loosen the single setscrew and turn up the cone with a nail, according to the type of bearing.

Then, by means of adjusting screws, set the stationary blade at the bottom so that it just touches the revolving blades all along their length—not tightly enough to bind, but enough to cause slight friction as they pass by. It is good practice to lower this bar before testing and adjusting the cylinder bearings, but in any case, it should be raised now to meet the revolving blades.

Turning on a short shaft on the disk behind each drive wheel is a small gear called the pinion.

Back of the pinion is a small bit of steel called a pawl. This engages the blades when the mower is pushed.



The points of the revolving blades, if too long, should be filed down on a slight bevel

Pull off the pinions and clean the pawls. If they are badly worn, either buy new ones or make them from a piece of tool steel, hardening them afterward. Then put back the pinions, after oiling the pawls thoroughly. Smear the gear teeth and pinion shafts with petrolatum.

A good method of home sharpening is to reverse the pinions, side for side, so that the blades will run backward, and replace the wheels. Mix fine carborundum powder with machine oil, work into a smooth paste, spread evenly over the stationary blade, and then push the machine upside down along the floor.

Keep pushing forward and backward until the blades will spin when the machine is brought to rest. Test for sharpness by inserting bits of paper between the stationary and revolving blades. If they are not cut clean when the blades are revolved, repeat the process with more carborundum compound and adjust the stationary blade closer to the cylinder, if necessary. A file can be used for beveling the extreme end of each blade where the points are apt to be left too high.

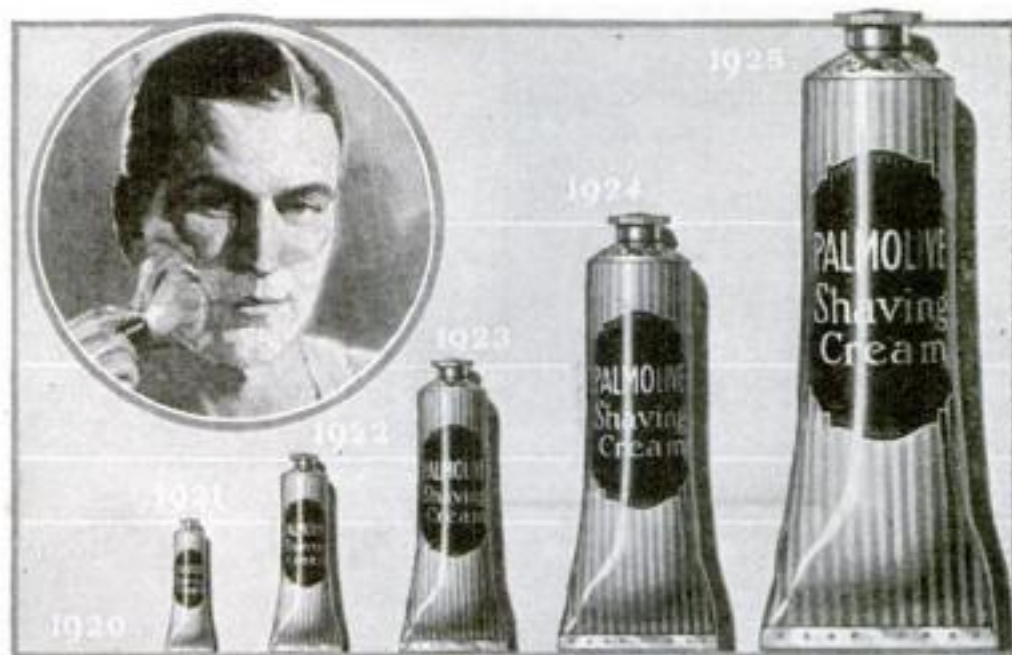
Clean off all grinding compound, replace the pinions in their proper order, and reassemble. All exposed movable parts should be oiled thoroughly; the remaining surfaces should be wiped with benzine or gasoline and painted.

An occasional oiling will, of course, help to keep the mower running quietly.

Men are quitting

—by the millions—old-type shaving preparations for this unique creation.

Accept, please, a 10-day tube to try



GENTLEMEN: Five years ago Palmolive Shaving Cream was unknown. Today it is leader in its field.

It is a unique creation. It differs immeasurably from any shaving soap you have ever tried. Eighty per cent of its users once were wedded to rival makes of shaving soaps.

It is based on the four requirements 1000 men named as their ideals of a shaving cream, plus a fifth . . . strong bubbles . . . which we ourselves added.

We think you will like it. Sixty years of soap study stand behind it. The same careful study that made Palmolive Soap the leading toilet soap of the world.

May we ask you, then, the courtesy of trying it, both in your interest and in ours?

These 5 Advantages

- 1—Multiplies itself in lather 250 times.
- 2—Softens the beard in one minute.
- 3—Maintains its creamy fullness for 10 minutes on the face.
- 4—Strong bubbles hold the hairs erect for cutting.
- 5—Fine after-effects due to palm and olive oil content.

We think we have done a great job. You may agree, or you may not. But in fairness to us both, please give it a fair trial. Send the coupon. Do this today.

THE PALMOLIVE COMPANY
(Del. Corp.)

CHICAGO

ILLINOIS

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well-groomed look. Try the sample we are sending free with the tube of Shaving Cream. There are new delights here for every man who shaves. Please let us prove them to you. Clip coupon now.



10 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-1166, The Palmolive Company (Del. Corp.), 3702 Iron Street, Chicago, Illinois.

Residents of Wisconsin should address The Palmolive Company (Wis. Corp.), Milwaukee, Wis.

A one-pipe smoker finds his tobacco

The problem of keeping an only pipe sweet, cool, and soothing has been solved by a Long Island haberdasher.

On the chance that a number of pipe smoking readers of this magazine may be in the same predicament that Mr. Lilienfeld found himself two years ago, we publish his letter for what it is worth:

Richmond Hill, L. I.

Larus & Bro. Co.
Richmond, Va.
Gentlemen:

I am sorry I cannot compete with the gentleman who is the proud possessor of 45 pipes of all shapes, forms and makes. I am the owner of one poor solitary pipe.

This pipe I have carried many long years. At times it has been a good pal, soothing me with its cool, mellow smoke; but at other times—Lord, how it could bite! I was at a loss to ascertain the reason why. Every time I changed the brand I would imagine that I had discovered a new find; but when another new tin was bought it was never the same.

Somehow or other I ran across Edgeworth. I believe it was recommended me at some cigar store. Since I was always ready to take a crack at anything I bought some. What a relief was the first pipeful! The old briar pipe became soothing again. Here surely was a find. I thought to myself "Will it last?" Strange or otherwise it has lasted. I have now smoked Edgeworth for the past 2 years and believe me someone will have to step some to make me switch.

Yours truly,
S. Z. Lilienfeld.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Company, 10 Q. S. 21st Street, Richmond, Va.

We'll be grateful for the name



and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidor holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRVA, Richmond, Va. —the Edgeworth station. Wave length 266 meters.

The Home Workshop

Remodeling a Mantelshelf

A Simple Way to Modernize an Old-Fashioned Fireplace

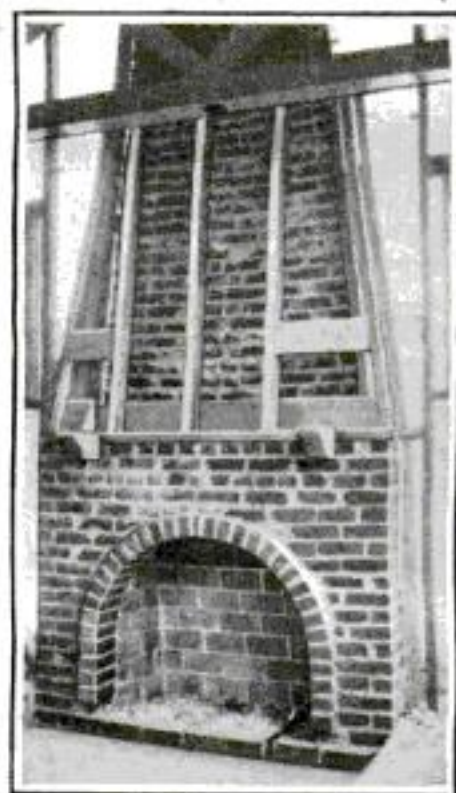
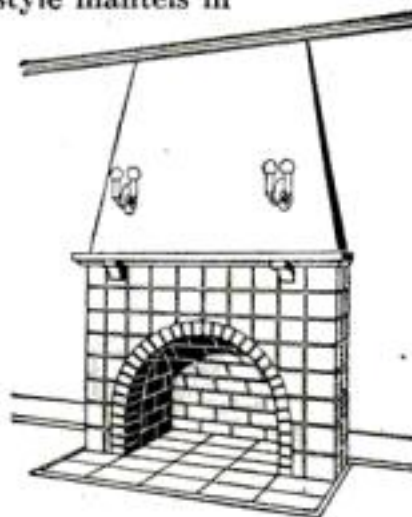
PRESENT-DAY modes in fireplace design favor the projection of the chimney into the room. It should rise straight up from the front and sides to the ceiling, or slope from the sides, or incline from the front and sides as well. If you have one of the old-style mantels in your living- or dining-room with a flat-topped mantelshelf, you can remodel it easily to conform to one of the other designs, and in that way bring the room more in harmony with the modern trend in interior decoration.

For the design illustrated, carefully remove the shelf by prying off the moldings with a chisel and lifting the shelf upward.

Make two brackets of 3 by 4 in. stock 12 in. long, and cut on the front edge of each a cove with a radius of $2\frac{3}{4}$ in. Cut a notch in the upper edge $4\frac{1}{4}$ in. back from the front end to receive a 2 by 4 in. plate, as shown in the sectional drawing.

Locate the positions of the brackets near each end, say 12 in. to the inner faces, and with a small chisel chip out the face tile or brick to receive the brackets. Start near the center and chip very carefully to avoid cracking the tile or loosening it. The backing brick can be attacked more boldly.

Nail the plate to the brackets and place the latter in the notches in the brickwork.



Interior decorators favor fireplaces built so as to give a lofty appearance

Return the plate to the wall at each end by butting short pieces against the front plate, and secure the ends by nailing them to a strip nailed on the wall. This groundwork should be well leveled and flush with the faces of the fireplace.

Plumb up on the wall to the picture mold from each end of the fireplace, and measure in at the top for a slope equal to the slope of the front.

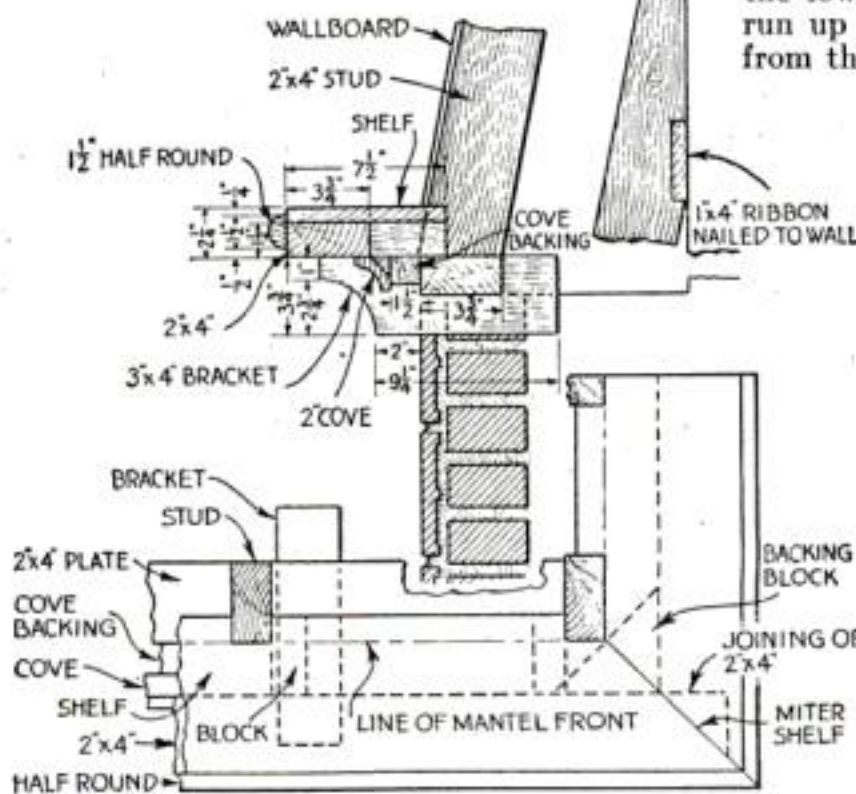
About 16 in. below the mold nail a 1 by 4 in. ribbon horizontally across the studs, ending at the slope lines, and nail 1 by 4 in. backing strips between the ends and the mantel plates.

Cut three front studs to fit the slope against the wall, notching them around the ribbon and fitting the lower ends to the plates, and run up corner studs to slope both from the front and ends. Tack up and test for alignment with a straightedge, and after any necessary alterations, nail up solidly.

Where the light brackets are to come, cut pieces of 1 by 6 in. boards between the outer studs, keeping them flush with the outside. Bore accurately placed holes through which to bring in the wiring, which may be extended through loom from the wiring of the old brackets, or, in the absence of these, wires can be tapped from the ceiling and brought down inside the built-out flue. The frame should now resemble that in photograph.

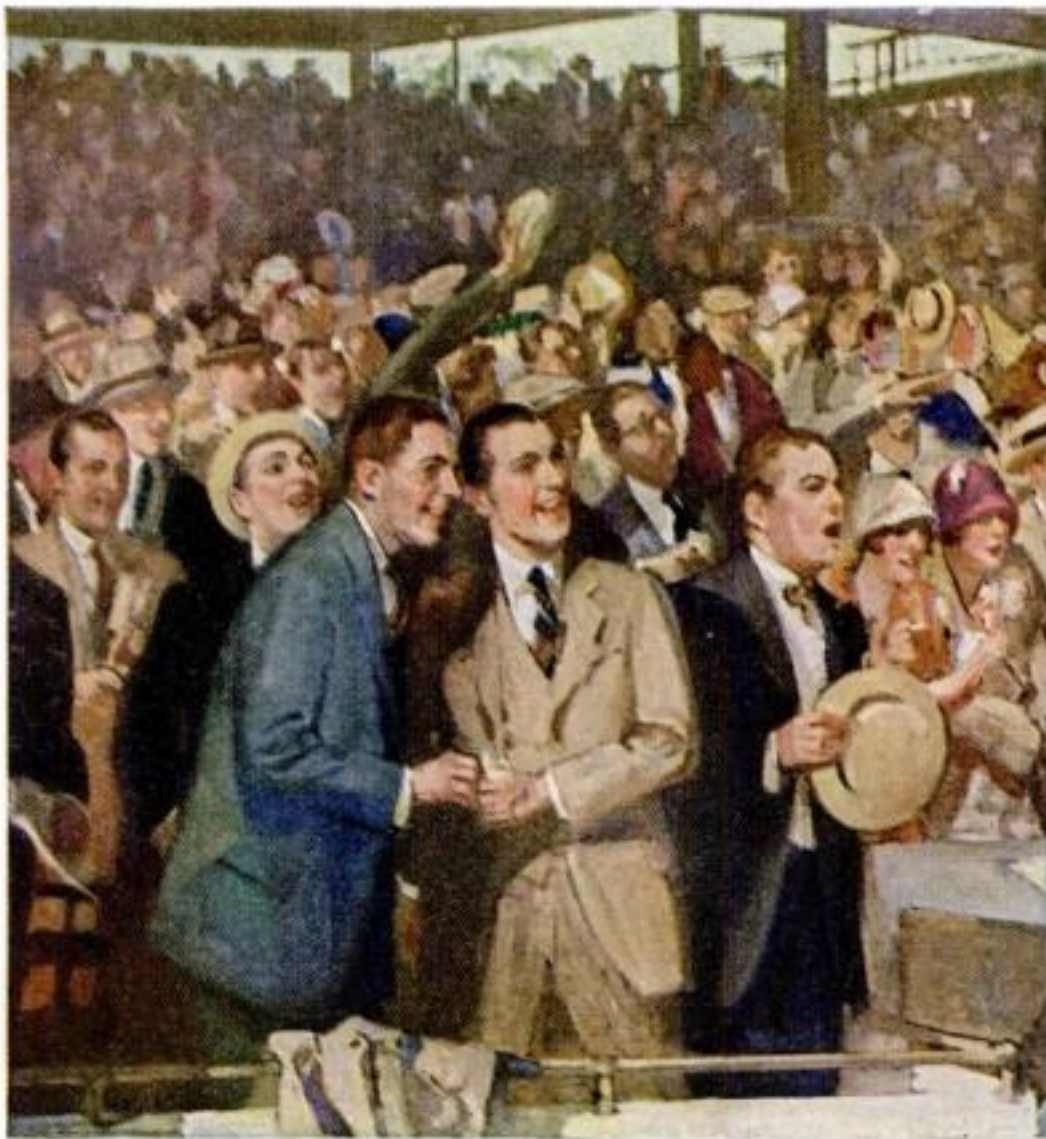
(Continued on page 81)

SECTION THROUGH MANTELSHLF



The upper view shows a section through the shelf and upper framework. The lower detail is a plan of the shelf corner

When you and spring
are thrilling to the first ball game of
the year—and your favorite player
drives out a homer—when the
stands rise, roaring with cheers
—have a Camel!



WHEN spring's first ball game is here. And a heavy hitter cracks the ball, shrieking into center-field for a home run—oh, happy mortal, as the stands roar with glee—have a Camel!

For Camel adds the magic of its own fragrance to life's most festive days. Camels are of such choice tobaccos that they never tire the taste. Camels are so skilfully made that they never leave a cigaretty after-taste. Spend what you may—you'll get more pleasure out of Camels than any other cigarette you ever put a match to.

So this fair spring day as the bases fill and a hefty batter lofts out one that it seems will never stop flying—oh, then, taste the smoke that means completed enchantment. Know then the mellowest flavor that ever came from a cigarette.

Have a Camel!



Camels contain the very choicest tobaccos grown in all the world. Camels are blended by the world's most expert blenders. Nothing is too good for Camels. In the making of this one brand we concentrate the tobacco knowledge and skill of the largest organization of tobacco experts in the world. No other cigarette made is like Camels. They are the overwhelming choice of experienced smokers.



Our highest wish, if you do not yet know Camel quality, is that you try them. We invite you to compare Camels with any other cigarette made at any price.

R. J. Reynolds Tobacco Company

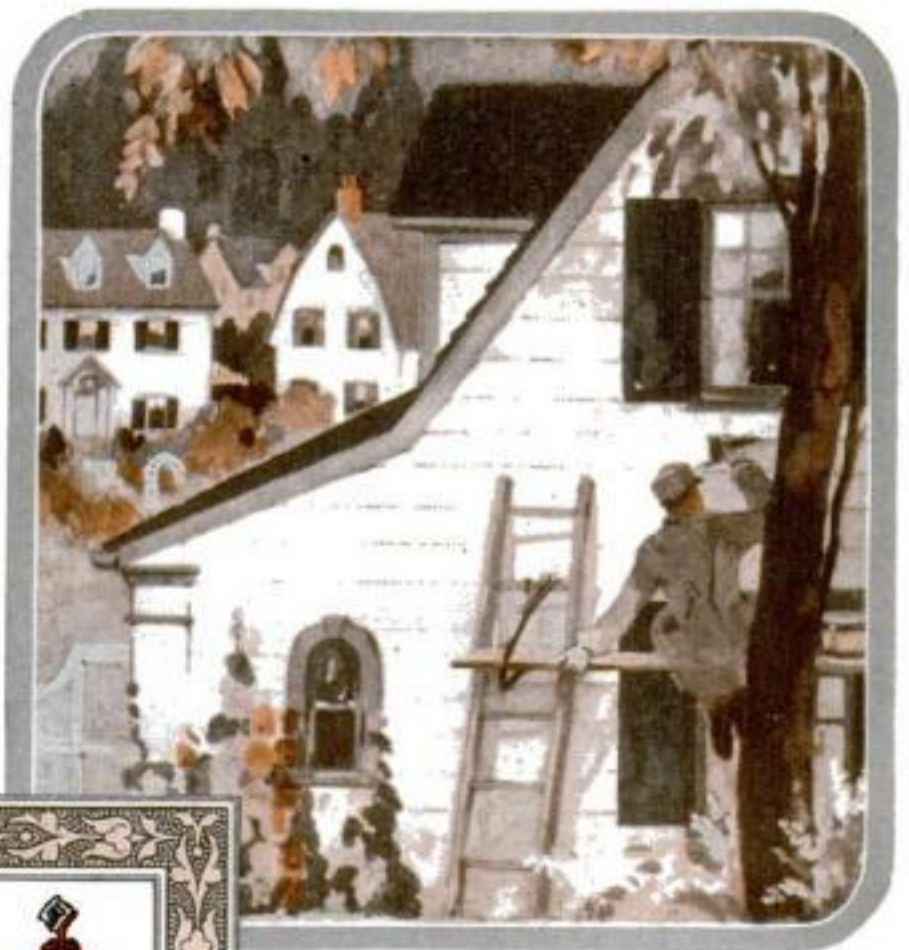
If you like "Popular Science"

you will like this

Here is a practical service for practical home decorators: Sherwin-Williams, who originated the now famous Household Painting Guide which gives authoritative information on correct finishes, have added a *color service*. You can now skilfully select a harmonious color treatment for anything, from a piece of furniture to a whole house. This, in effect, brings to any work you may do the full abilities of the experts in the Sherwin-Williams Decorative Studios.

These *color recommendations* are reproduced in beautiful pictures and, like the Household Painting Guide, may be seen at "Paint Headquarters," the live paint store in your community. Look for this store—you will recognize it by the sign.

For a beautiful and valuable Sherwin-Williams brochure on home decorating send the coupon printed below. Write the Sherwin-Williams Company, Dept. E, 659 Canal Road, Cleveland, Ohio.



HOUSEHOLD PAINTING GUIDE

STOPS MISTAKES IN PAINTING



SURFACE	TO PAINT USE PRODUCT NAMED BELOW	TO VARNISH USE PRODUCT NAMED BELOW	TO STAIN USE PRODUCT NAMED BELOW	TO ENAMEL USE PRODUCT NAMED BELOW
AUTOMOBILES	S-W Auto Enamel	S-W Auto Enamel Clear		S-W Auto Enamel
AUTOMOBILE TOPS AND SEATS	S-W Auto Top and S-W Auto Seat Dressing			
BRICK	SWP House Paint S-W Concrete Wall Finish			Old Dutch Enamel
CEILINGS, Interior . .	Flat-Tone	Scar-Not Varnish	S-W Handcraft Stain Floorlac	Enameloid
Exterior	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
CONCRETE	S-W Concrete Wall Finish			
DOORS, Interior	SWP House Paint	Scar-Not Varnish Velvet Finish No. 1044	Floorlac S-W Handcraft Stain	Enameloid
Exterior	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
FENCES	SWP House Paint Metallic S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
FLOORS, Interior (wood)	S-W Inside Floor Paint	Mar-Not Varnish	Floorlac	S-W Inside Floor Paint
Concrete	S-W Concrete Floor Finish			S-W Concrete Floor Finish
Porch	S-W Porch and Deck Paint			
FURNITURE, Indoors . .	Enameloid	Scar-Not Varnish	Floorlac	Old Dutch Enamel
Porch	Enameloid	Rexpar Varnish	S-W Oil Stain	Enameloid
HOUSE or GARAGE Exterior	SWP House Paint	Rexpar Varnish	S-W Preservative Shingle Stain	Old Dutch Enamel
LINOLEUM	S-W Inside Floor Paint	Mar-Not Varnish		S-W Inside Floor Paint
RADIATORS	Flat-Tone S-W Aluminum or Gold Paint			Enameloid
ROOFS, Shingle	S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
Metal Composition	Metallic Ebonol			
SCREENS	S-W Screen Enamel			S-W Screen Enamel
TOYS	S-W Family Paint	Rexpar Varnish	Floorlac	Enameloid
WALLS, Interior (Plaster or Wallboard)	Flat-Tone SWP House Paint			Old Dutch Enamel Enameloid
WICKER	Enameloid	Rexpar Varnish	Floorlac	Old Dutch Enamel
WOODWORK Interior	SWP House Paint Flat-Tone	Scar-Not Varnish Velvet Finish No. 1044	S-W Handcraft Stain S-W Oil Stain Floorlac	Old Dutch Enamel Enameloid

For removing paint and varnish use Taxite. For cleaning painted and varnished surfaces use Flaxosp.

Beautiful and Preserved

S W P is the highest-quality house paint it is possible to manufacture. If quality pays anywhere it is in house paint. It costs as much for labor, with short-lived paint, as with S W P, which goes farther, covers better, holds its color and wears so much longer that it pays many times over. "There is no substitute for quality."



FREE BEAUTIFUL COLOR IDEAS

Send this Coupon

Give us your name and address and receive, entirely free, a very special art brochure for lovers of beautiful homes. Lovely interiors and exteriors in colors. Samples of many popular shades—each a correct Sherwin-Williams product, as specified on the Household Painting Guide. Send the coupon today, to the Sherwin-Williams Co., Dept. E, 659 Canal Road, Cleveland, Ohio.

NAME _____
ADDRESS _____

SHERWIN- PAINTS AND

WILLIAMS VARNISHES



The Home Workshop

Miniature Kitchen Cabinet



TWO prizes—a blue and a red ribbon—were awarded at a county and a community fair to the miniature kitchen cabinet illustrated. I made this by following an article in the January, 1924, issue of POPULAR SCIENCE MONTHLY.

The cabinet was constructed of yellow pine with wall-board panels.

It was given one coat of flat white and a thin coat of white furniture enamel.

The ornamental design and initials were drawn outside the glass doors with a pencil-shaped piece of laundry soap and then painted on the inside with gold enamel.—ROY C. BRADBURY.

Remodeling a Mantelshelf

(Continued from page 80)

For the shelf, use 1 by 8 in. stock, well surfaced. Miter the corners, butt the returns at the ends against the wall by scribing them to the plaster, and notch around the false studs to give a projection of $1\frac{1}{2}$ in. beyond the bracket ends.

Flush with the face edge on the under side nail a 2 by 4 in. piece, surfaced four sides. Miter the corners for $\frac{1}{2}$ in., and shoulder the rest of the joint, as shown in the plan view.

Glue this joint to the miter of the shelf, and further reinforce the miter joint by gluing and nailing under it a triangular "scab," as indicated. So treated, the miter in the shelf should open very little through shrinkage.

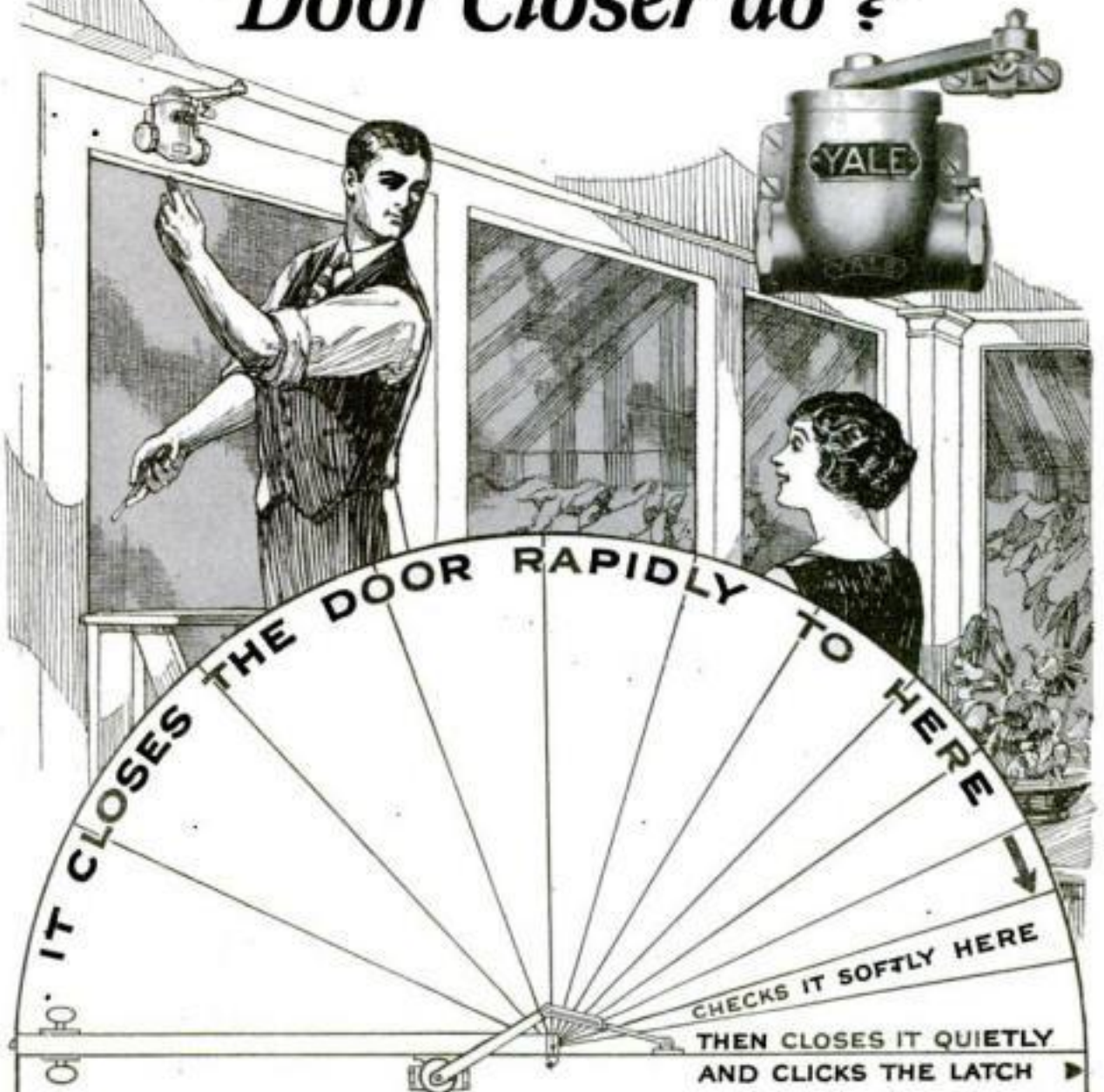
To support the rear edge of the shelf, nail a block against each stud, bearing on the plate and against the 2 by 4 in. piece on the under side of the shelf. Between the brackets nail a $1\frac{1}{4}$ by $1\frac{1}{2}$ in. strip flat against the under edges of the blocks and against the plate, and miter a 2-in. cove around under the shelf with this strip as a backing. Miter a $1\frac{1}{2}$ -in. half-round molding to the shelf edge, showing a margin of $\frac{1}{4}$ in. above.

Cover the false studs with wallboard, carefully fitting the end pieces against the wall and mitering the corners. Decorate to match the room, and put up the lighting fixtures.

If it is desired to run the face of the flue plumb from the mantel face, nail suitable cleats to the ceiling against which to secure the upper ends of the studs.

Where the fireplace itself is boxed in and the removal of the shelf would be likely to damage the woodwork, the upper frame may be erected above the old shelf without further alterations, or a wider shelf can be built over the old.—EDWIN M. LOVE.

Just what does a TRADE **YALE** MARK Door Closer do ?



The Yale Door Closer is a door-closing power plant: perfect in action; made with the precision of a smooth-running engine; every part co-ordinated to the quiet closing of a door.

As the door is opened the power of a highly tempered steel spring is stored up waiting for release. As the hand leaves the knob the spring unwinds, promptly starting the closing action, and at the right moment, controlled by a piston working within its cylinder against hydraulic pressure, the door gradually loses momentum and comes to a quiet stop as the latchbolt clicks in the jamb.

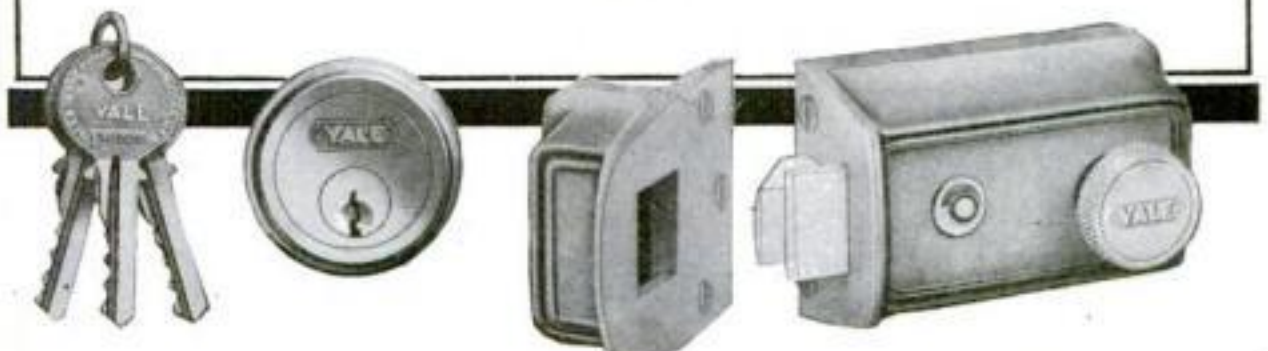
Put Yale Door Closers on those Screen Doors this summer.

No more noisy annoyance from slamming screen doors. No more half-shutting of the door, with flies entering in spite of the screen.

The Yale & Towne Mfg. Co., Stamford, Conn., U.S.A.

Canadian Branch at St. Catharines, Ont.

YALE MARKED IS YALE MADE



TRIMO

America's Leading Pipe Wrench—Why?



You can see with the naked eye why the TRIMO is America's leading Pipe Wrench, having strength, durability, economy and convenience built into its whole make-up. Good tools are the cheapest in the long run.

Three features make the TRIMO America's leading Pipe Wrench (1) INSERT JAW in the handle, replaceable when worn (2) NUT GUARDS that keep the wrench adjusted in close quarters and (3) STEEL FRAME that will NOT break. Eight steel handle sizes from 6 to 48 ins. Four wood handle sizes: 6, 8, 10 and 14 ins.

THE TRIMO Monkey Wrench

Is simple, strong and all drop forged; has only four parts. Fully guaranteed, needed by every mechanic. Ask your dealer for these TRIMO TOOLS—accept no other.

TRIMONT MFG. CO.
Roxbury, Mass.

303

The Home Workshop

Wood Turning *without* a Lathe

By RUFUS E. DEERING

WOULD you believe that you can make graceful, spirally turned legs for homemade furniture with the commonest of hand tools, and do it more easily than you could shape almost any of the much commoner types of posts? Most beginners in woodwork would say it is impossible, yet the process is really simple. The steps in shaping the spirals, which can be made any size desired, are shown below.



1 Shape the part round with draw-knife, pocket-knife, or a wood rasp. It need not be smooth but should be round



2 Cut a long strip of paper as wide as the pitch desired, wrap it around the wood as shown at the left; then mark the spiral with a pencil



4 Use the edge of a half round wood rasp to deepen and widen the narrow groove previously made with a hand saw



5 (Above) Finish shaping the spirals with a rasp



3 Carefully saw a 1/4-inch deep groove about the length of the spiral



7 Hold a piece of sandpaper in the palm of one hand and rotate the work to finish smoothing the continuous spiral surfaces



6 Smooth very carefully with sandpaper wrapped around file or stick

8 (At left) Work out knobs, balls, octagons and other shapes with wood rasps and coarse bastard files, finishing with sandpaper



The Home Workshop

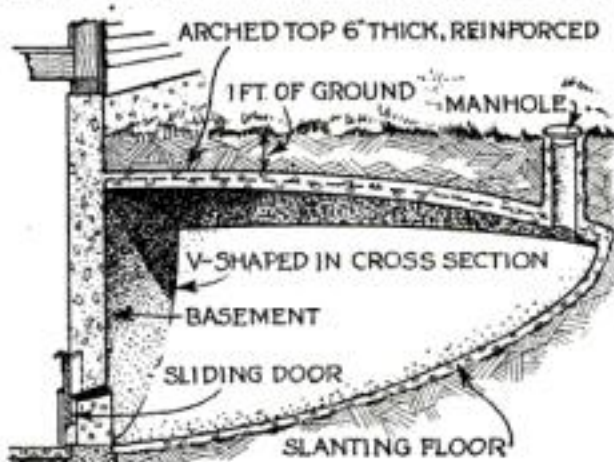
How I Improved My Cellar by Making a Coal Vault

By EUGENE L. GIESE

TO KEEP costs down, the builders of many homes plan for small basements. In my home, this defect was remedied by building a coal bin outside the foundation wall. Besides affording more room, it allows the basement to be kept cleaner and to be put to more uses.

The concrete bin holds six tons and has a manhole conveniently located for filling. The bottom slants rather steeply toward the coal opening in the basement.

The forms for the concrete are placed in the excavation somewhat in the shape



An excavation is made outside the cellar and a concrete vault or bin is constructed

of a V, so that the top of the bin is noticeably wider than the bottom. This facilitates the feeding of the coal to the coal opening in the cellar. The top of the bin is a foot or more below the ground so that it will not interfere with planting.

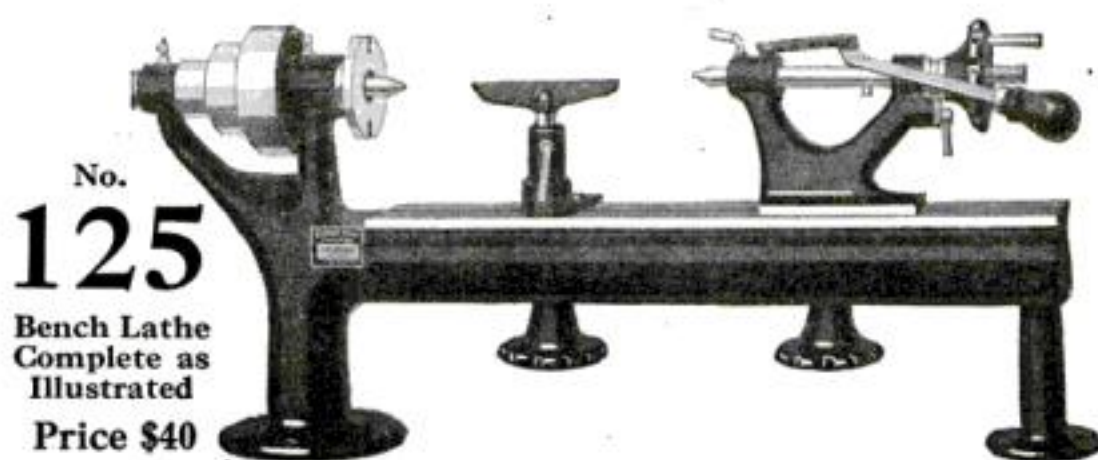
Not until after the concrete walls have set for several days are the forms for the roof of the bin placed in position. The top is in the shape of a flat arch and is made of concrete at least 6 in. thick, with reinforcing, so that the roof will support a reasonable weight. The writer used steel lath for reinforcing the roof.

A sliding coal door in the basement was found to be the most satisfactory. The frame was made from 2 by 8 in. material, grooved to hold a stout door.

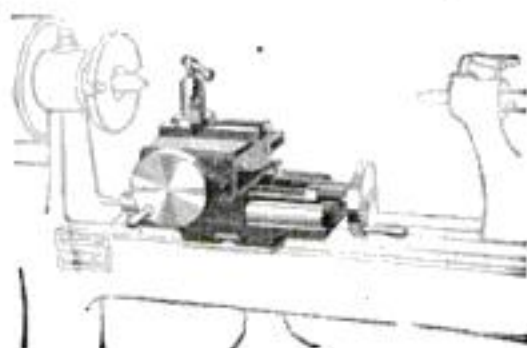
Have You a Good Idea?

IN CONNECTION with William Draper Brinckloe's article, "How to Utilize Your Cellar," published last month, we asked readers who have worked out good ways of using their cellars to send letters describing their ideas to the Editor. Payment will be made for letters suitable for reproduction.

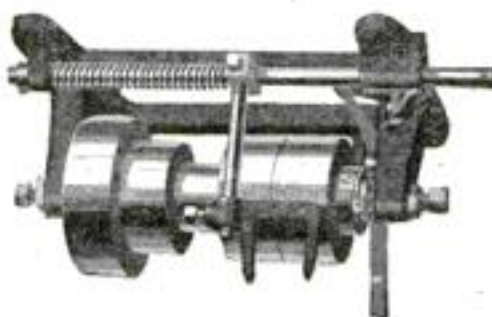
The suggestion in the above article is of special timeliness, as many householders ran out of coal during the strike last winter and suffered great expense and inconvenience simply because their coal bins were too small to hold a winter's supply.



This bench lathe makes your home shop a real workshop



THERE are many turning and boring jobs you could do yourself if you had a bench lathe. Make your workshop more complete by adding to it this Goodell-Pratt Lathe. It enables you to do professional-looking work. Over-all length of this bench lathe is 25 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 12 inches. It weighs only 30 pounds.



This lathe has a milled bed and a tail stock with milled base. Live spindle has a cone bearing to take up wear. The tail stock has both screw and lever feed. Cone pulley has 3 steps—1½, 2½, 3½ inches in diameter. The lathe is finished with black and red enamel. All working parts are beautifully polished.

A complete line of attachments is available to fit this lathe. Among them are a slide rest, lathe tools, compression check and collets, milling attachments, turret attachments.

Bench Lathe No. 494

This lathe has the same construction as the No. 125 above, but is slightly larger. Length over all, 31 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 18 inches. Net weight, 36 pounds, price \$44.

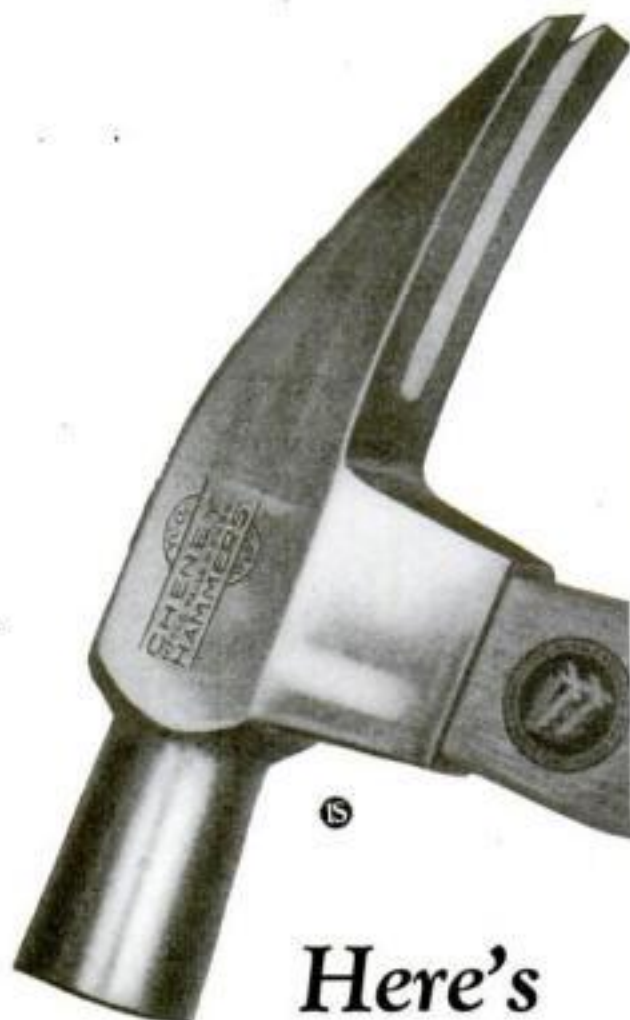
400-page Book of Tools FREE

A postcard will bring you the 400-page pocket-size book of all the famous 1500 Goodell-Pratt tools. In this book are shown and described many tools you will want to outfit your workshops completely. Every tool shown is beautifully made and finished by skilled toolmakers. Just let us know where to send your copy of the book. It is FREE.

GOODSELL-PRATT COMPANY
GREENFIELD, MASS., U. S. A.

Makers of Mr. Punch

GOODSELL-PRATT
1500 GOOD TOOLS



Here's
your best bet!

Cheney hammers

When you pick a Cheney you pick a winner.

It's a hammer that will stand a lot of wear and tear—even abuse. It's a hammer that will be right on the job long after most other hammers have been put in the junk pile.

The first time you use a Cheney you'll be tickled with the "hang" and the "Never-Slip" grip, and you'll recognize the real value of heads whose ends are tempered differently—each according to the work it is to do—, of wax-finished second growth hickory handles, and a system of wedging that keeps the head tight.

That's why for 90 years men have been asking for the Cheney Hammer. They've wanted the hammer made of the stuff that stand the gaff. And there's a real guarantee that it will stand the gaff—even stand abuse—back of every Cheney Hammer.

PRENTISS VISE CO.
105-110 LAFAYETTE ST. NEW YORK CITY.
VISE CO.
CHENEY HAMMERS

9018

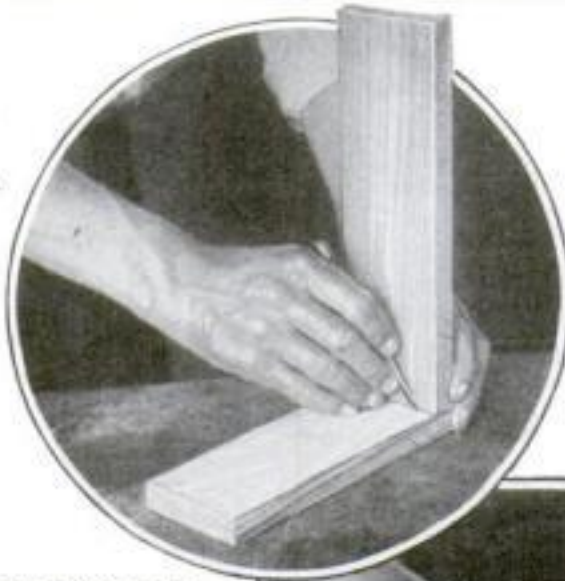
The Home Workshop

How to Make a Rabbeted Joint

By EMANUEL E. ERICSON, *Noted Manual Training Authority*

AMATEUR mechanics who nail and screw together their woodwork without any pretense at joinery are missing half the fun of wood-working. To make a workman-like joint gives real delight. This and similar articles to come will show you the secrets of cabinetmaking.

You will find many uses for rabbeted joints in making furniture, and, indeed, in all sorts of woodwork. Drawer fronts, for instance, are often rabbeted to take the side pieces, instead of being dovetailed. Sometimes this is called an end-lap joint.



1 After face-marking the pieces, place one member on the other and even at the end and edges, and make a mark in the inner corner as shown at left. Both pieces, it might be well to remind the amateur, should have carefully squared ends



2 Remove the vertical member and place the knife in the mark previously made. Then move a try-square against the knife and draw a line across the surface. Continue the line halfway down each edge. On rough work a pencil is used instead of a knife, but it is easier to work accurately to a knife line



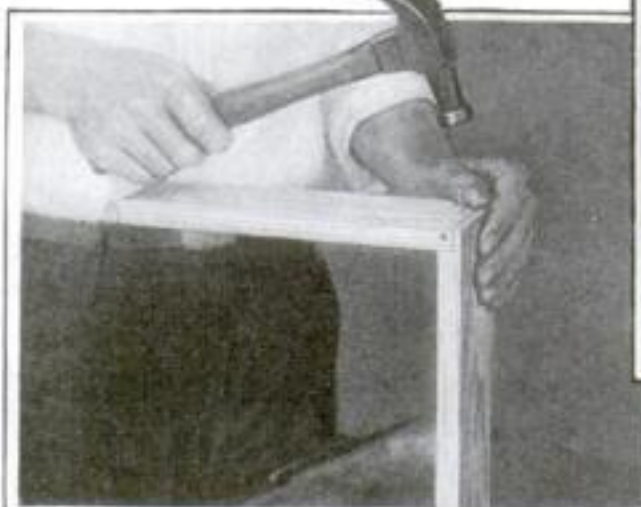
3 (Above) Set a marking gage for whatever amount of end grain is to remain visible in the rabbeted member—this may be one half the thickness, but usually is less. Gage along the end and down to the knife lines along the edges



4 (At left) Place the piece in a vise and cut down on the gage lines with a rip-saw, beginning the cut on the nearer corner. As you proceed with the cutting, bring the saw level



5 Lay the piece flat on a bench hook or fasten it in the vise and cut away the surplus wood with a cross-cut or back-saw. Beginners usually find it best, and it is always safest, to cut a V-groove with a knife or chisel before making a saw cut of this kind



6 Glue the joint and fasten with plenty of finishing nails or screws, at the same time testing for squareness

The Home Workshop

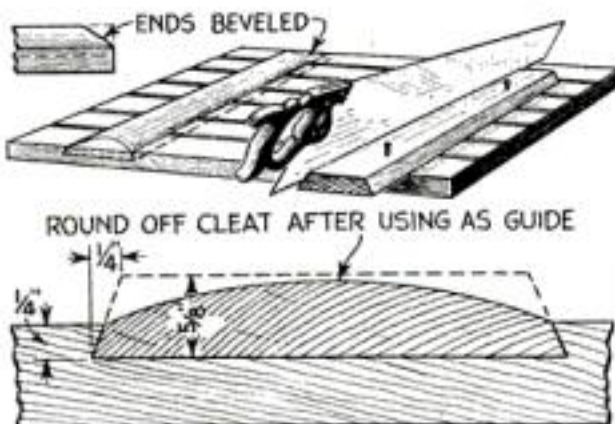
Easy Way to Make Small Cupboard Doors

By DONALD A. PRICE

SMALL cupboard doors with dovetail battens running the full width can be made quite easily. For instance, if a door 22 by 26 in. is required, cut the tongue-and-groove material approximately the right size. Nail it down lightly on the workbench or any other flat working space.

The size of the cross cleats, in this case $3\frac{1}{2}$ in. wide at the wider end, should be determined, and they should be given a taper of $\frac{1}{2}$ in. to the foot, or, in this instance, made $2\frac{1}{2}$ in. at the narrow end. They should be about 2 in. longer than the finished width of the door. Both edges should be beveled as shown by the dotted lines.

Nail the finished cleats temporarily on the door on their proper center lines so



The cleats are tacked temporarily on the door as a guide in making the dovetail saw cuts

that they will serve as templates for cutting the grooves. The small end should be placed a short distance inside the edge of the door, as illustrated, to allow for the thickness of the saw kerfs. This distance will vary from 1 to 2 in., according to the thickness of the saw.

The saw can be guided by holding it tightly against the beveled edges of the cleat. Make the saw cuts $\frac{1}{4}$ in. deep on both sides, remove the cleat and rout the groove to a depth of $\frac{1}{4}$ in. over all. Then round the top of the cleat, coat the groove with glue, and drive the cleat in as far as it will go. Cut off the ends and bevel them to give a neat finish.

It is necessary, of course, to attach the hinges to the cleats. Variations of this method can be used for other work, such as making a shop drawing-board that will stay flat, in which case, however, glue the cleats only at the center to allow the board to expand and contract.

A Rotating Harrow

(Continued from page 73)

bolt. Do not overlook the two washers that prevent the cramping of the parts.

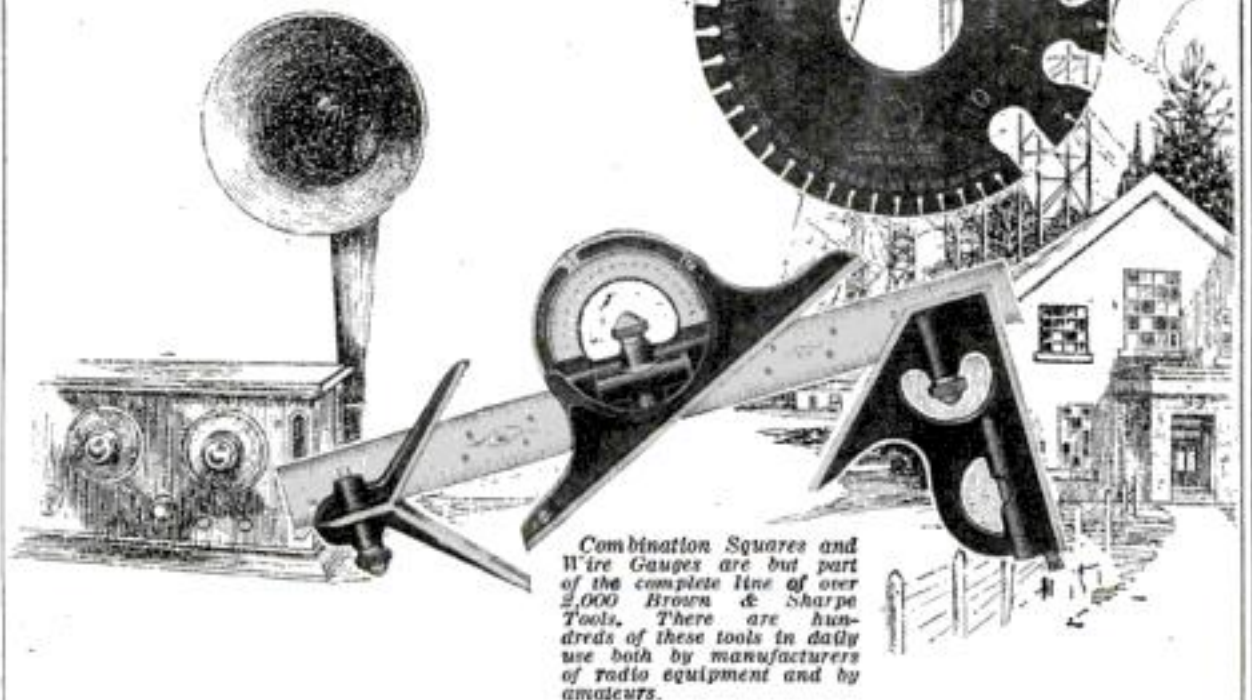
A handle, made from a piece of broomstick, extends about 16 in. on each side of the tongue.

As the harrow is pulled along, the spikes at one side stick into the ground while those on the other side slide over the surface, causing the harrow to revolve, thus breaking up and leveling the clods.—GEORGE G. McVICKER.

The World at your door by the turn of a dial— because of Good Tools!

When you hear the sweet, clear music from a concert over a thousand miles away you do not, perhaps, think of the tools which have brought about this marvel. Wire, tubes, storage batteries, motors, generators, and microphones must be made accurately. In their manufacture, you would find hundreds of Brown & Sharpe wire gauges, screw pitch gauges, micrometers and many other tools for the accurate measurement of thousands of small parts.—You'll find Brown & Sharpe Tools on all jobs where tools of the highest quality are required.

Catalog No. 30 lists the complete line of Brown & Sharpe Tools and Cutters. Ask your dealer for a copy or mail a post card direct to us.



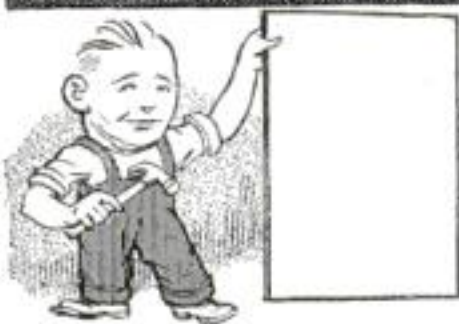
Combination Squares and Wire Gauges are but part of the complete line of over 2,000 Brown & Sharpe Tools. There are hundreds of these tools in daily use both by manufacturers of radio equipment and by amateurs.

BROWN & SHARPE TOOLS

BROWN & SHARPE MFG. CO.

Providence, R. I., U. S. A.

UPSON-BOARD for WALLS



Do you need extra rooms? Do you want to install extra partitions—make your attic livable?

for CEILINGS



Try Upson Board on just one cracked or falling ceiling. Light in weight—easy to apply. Cannot crack. You'll agree there's nothing better.

for INSULATION



Is your house hard to heat? You can cut your fuel bill 20% to 30%—add needed rooms at the same time—by lining your attic with Upson Board.

for SHEATHING



Identify genuine Upson Board by the Blue Center in panel edges.

Laboratory tests prove Upson Board 25% to 200% stronger than ordinary sheathings. Strengthens—insulates—enhances investment.

You are sure to have at least one use for Upson Board about your home. Why not try it on just one ceiling? You'll like it! Send 10c for samples and full-size detail blue print specifying use desired. Address The Upson Company, 527 Upson Pt., Lockport, New York.

WRITE FOR SAMPLES

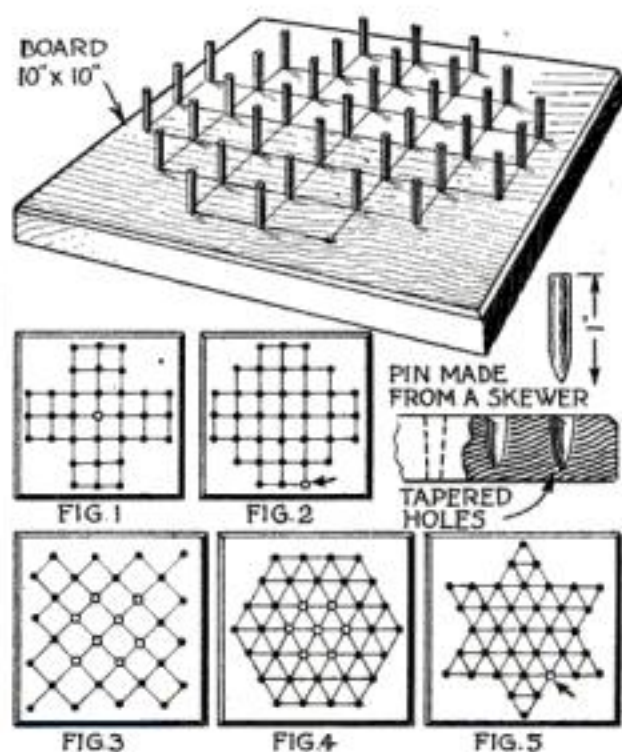
The Home Workshop

Five Curious Puzzle Boards

By ARTHUR L. SMITH

THE OLD game of solitaire will furnish a great fund of amusement for all members of the family in reward for a few hours' work in making the board. It opens up a wide field for those of an inventive mind, who may delight in devising new forms of the game. Those of a mathematical turn of mind will find pleasure in discovering the underlying law that governs the position of the counters, making a solution either possible or impossible.

Boards may be made of any suitable material and embellished to suit the taste of the constructor. The simplest way is to draw on a board about 10 in. square any



Unusual variations of standard solitaire game boards (Figs. 1, 2) are shown in Figs. 3, 4 and 5

one of the designs illustrated, or an original one.

Holes are drilled or punched at all the intersections. They are best if tapered, and the writer has used a center punch in making them, after grinding it to the taper desired. There is little danger of splitting the board if care is taken.

To make the pegs, a handful of wooden skewers may be obtained from a butcher. A point is ground on the end of one with a pencil sharpener and the peg cut off to the proper length, about 1 in. A sufficient number of pegs can be made by this method in a short time.

After the pegs are inserted, the problem consists of jumping them out, as in the game of checkers. A true solution is reached when all the pegs are taken but the last, which should land in the central hole whenever the design permits it.

If preferred, counters or checkers may be used instead of pegs, and round or square spots painted on the board in place of holes.

Figs. 1 and 2 are the standard games of solitaire mentioned in dictionaries and encyclopædias. Fig. 3 is an old checker

puzzle adapted to the peg board. Figs. 4 and 5 are designs to show how new games may be devised.

In Figs. 1, 2 and 5, pegs are put into all the holes and the player has the choice of removing any one in order that the jumping process may begin. In Fig. 1, a true solution is possible if the central peg is removed. In Fig. 2 it is doubtful, though it is left as an open question for the reader to decide.

Solutions are given that leave pegs standing in all the circumferential holes while the last one lands in the center, but this does not seem to be bona fide. If a corner peg (indicated in the drawing by a circle) is removed, the pegs can be jumped out, but the last one will be most contrary about landing in the center.

In Fig. 5, the case is similar to that of Fig. 2. The pegs may be jumped out if the peg indicated in the drawing by a circle is removed instead of the central one.

Twenty-four pegs are employed in Fig. 3. They occupy the two outer rows, while eight holes are left vacant in the center of the board. As it stands, a solution is probably impossible, but it becomes possible if, at the beginning of the game, one peg may be removed, or if one peg may be added in one of the two central holes, or if one of the inner pegs not in the lines connecting the double corners may be moved one space in.

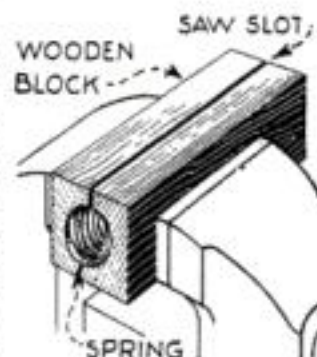
The player who tries to work the puzzle as it stands usually becomes confused after intense mental effort and unconsciously inserts or removes a peg and is delighted when all are jumped.

In Fig. 4, a similar design is offered in which seven inner holes are left vacant. A true solution can be effected here, and you will be delighted to see the last man land obligingly in the center.

The third article in this series by one of the foremost authorities on puzzles will appear in an early issue.

A Quick Way to Make Rings

I RECENTLY devised the method illustrated for making a number of wire rings out of a closely coiled spring. After boring a hole slightly larger than the coiled spring through a block of wood, I made a



saw cut to serve as a guide for a hacksaw and then placed the block and spring in the vise. Cutting through one side of the spring resulted in a series of rings, each of which could be closed and flattened with a few taps of a hammer.—W. J. E.

The Home Workshop

Easiest Way to Wire Lamp

By GEORGE A. WILLOUGHBY

Supervisor of Electric Work, Arthur Hill
Trade School, Saginaw, Mich.

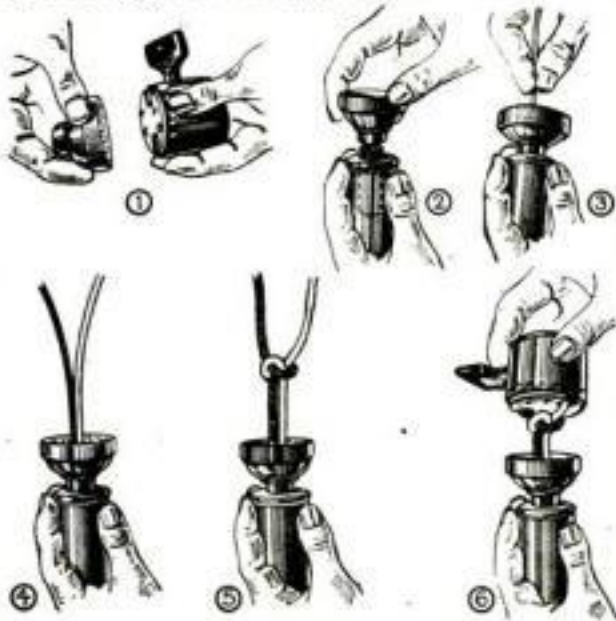
FROM the shelf above his cellar workbench, Fred Andrews, one of my neighbors, lifted carefully a pair of silver and blue candlesticks.

"What do you think of them?" he asked. Before I could tell him how much I liked them, he went on: "You know I found them knocking around the attic. They must have belonged to my grandmother. All I did was to wash off the dust and soot of forty years, give them a coat of gesso, and polychrome them. What I want you to tell me, though, is how to wire them for electric light."

"That's easy," I said, "but you'll need a hole all the way through for the wire."

"That was the first thing I did," Fred said—"bored a hole all the way through."

"Then you will need two short pieces of one eighth inch pipe, each threaded at



How to perform the six simple operations necessary in wiring a single electric lamp

one end; two sockets, and some silk lamp cord. All you have to do is to enlarge the hole in the top of the candlestick—the same method, by the way, will do for any kind of small lamp you happen to be wiring—so that the short length of gas pipe can be pushed firmly into it. Now then, take the socket apart by pressing the shell at the point marked 'press.' Screw the cap of the socket onto the small pipe, and push the cord through the candlestick, pipe, and cap. If it is too tight a fit, push a stiff wire through first and draw the cord after it.

"Next, split the cord carefully, without removing the rubber covering, tie an Underwriters' knot in it, scrape the insulation from the very ends, attach the wires to the socket terminals, and assemble the socket in place."

Fred thought this was an easy way of doing it, as, indeed, it is. Frames for bed lamps, in particular, often are sold with a small piece of pipe in place, so that it is necessary only to cover the frame with suitable cloth and connect up the socket.

It is essential not to omit tying the Underwriters' knot. Mr. Willoughby told how on page 108 of March issue.



Teeth that take hold!

"The beaver," says the encyclopedia, "builds his dam of stems and boughs cut down by his powerful teeth."

Beaver-like in their ability to take hold and finish their job are the teeth of NICHOLSON Files. Whether made for rough machine work, the home repair shop, or the super-fine filing of the jewelry craftsmen, these teeth are cut just right to meet the particular need.

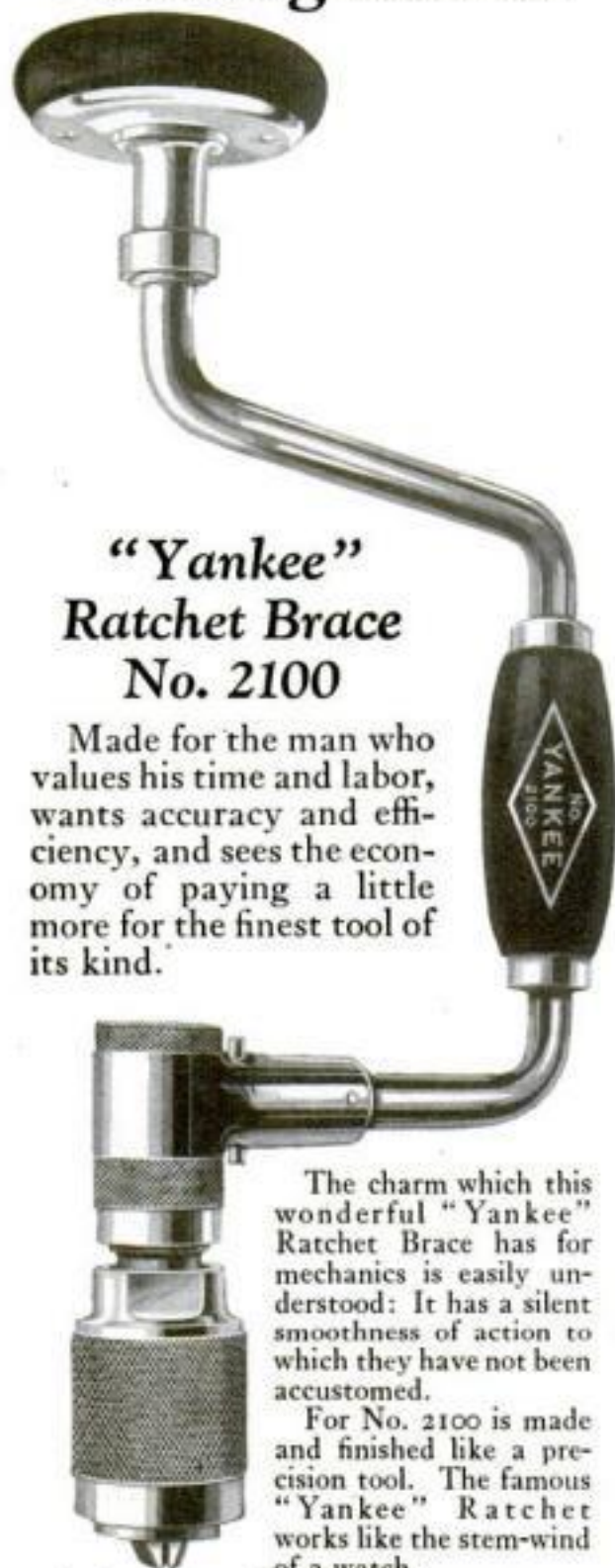
They are tested again and again—rigidly—before they are sent to work.

NICHOLSON FILE CO.
Providence, R. I., U. S. A.

NICHOLSON
U.S.A.
(TRADE MARK)

~ a File for Every Purpose

Whets your Appetite for Boring Holes



"Yankee" Ratchet Brace No. 2100

Made for the man who values his time and labor, wants accuracy and efficiency, and sees the economy of paying a little more for the finest tool of its kind.

The charm which this wonderful "Yankee" Ratchet Brace has for mechanics is easily understood: It has a silent smoothness of action to which they have not been accustomed.

For No. 2100 is made and finished like a precision tool. The famous "Yankee" Ratchet works like the stem-wind of a watch.

And the new "Yankee" Chuck is the most efficient ever made. Ball bearing, quick centering, and accurate. Slip into it any shape bit (round, square, any taper) and the bit is held in a vise-like grip. Yet chuck releases bit at a turn of wrist.

Handles are hard rubber and indestructible.

Finished beautifully in keeping with its perfect mechanism.

Some Other "Yankee" Tools

Ratchet Breast and Hand Drills Automatic Feed Bench Drills
Ratchet Screw-drivers Automatic Push Drills
Push Braces Vises, Removable Base

Dealers Everywhere Sell "Yankee" Tools

"Yankee" on the tool you buy means the utmost in quality, efficiency, and durability.

Write for FREE "Yankee" Tool Book.

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

You Can Make This Galleon

(Continued from page 71)

away the sides of the hull pieces B until they fit the templets at the six construction lines II to VII. Hold the two pieces together and see that they match. If you deviate from the actual section lines, it is of no particular importance; the main thing is to see that pieces B are approximately alike.

Glue and lightly nail pieces B to the center piece, so that the construction lines on all three correspond.

To lighten the model it is desirable, but not at all necessary, to scoop out a lot of the inside wood, leaving at least $\frac{3}{8}$ in. at the edges.

Bore the nine $\frac{3}{16}$ -in. holes for the cannon about $\frac{1}{2}$ in. below the edge, so that the guns will point slightly up, and forward and aft at the ends. (See Fig. 1.)

Obtain, if possible, a piece of $\frac{1}{8}$ -in. three-ply wood (airplane or waterproof stock), which can be had from some veneer dealers in 2-ft. square pieces. Otherwise

use heavy cardboard, several thicknesses of thin cardboard glued together, or, better still, glue together five thicknesses of thin wood veneer with casein (water-proof) glue.

Take a piece $5\frac{1}{2}$ in. wide and 18 in. long and cut it approximately to the shape of the main deck D, Fig. 2. This, as well as two of the other decks, will need a slot at the ends to fit around the center piece, which makes the whole rigid. Glue and nail the main deck in place (after noting the suggestions given later on in regard to fastening the bitts), and trim the edges to agree with the side pieces.

Cut two bulwarks from the same material to the shape shown at C, Fig. 2, and in them cut the $\frac{1}{4}$ -in. square gun ports and the $\frac{1}{4}$ -in. round hawse hole. Bevel the forward edge so that it fits snugly against the center piece. Leave $\frac{1}{4}$ in. extra length at

(Continued on page 90)

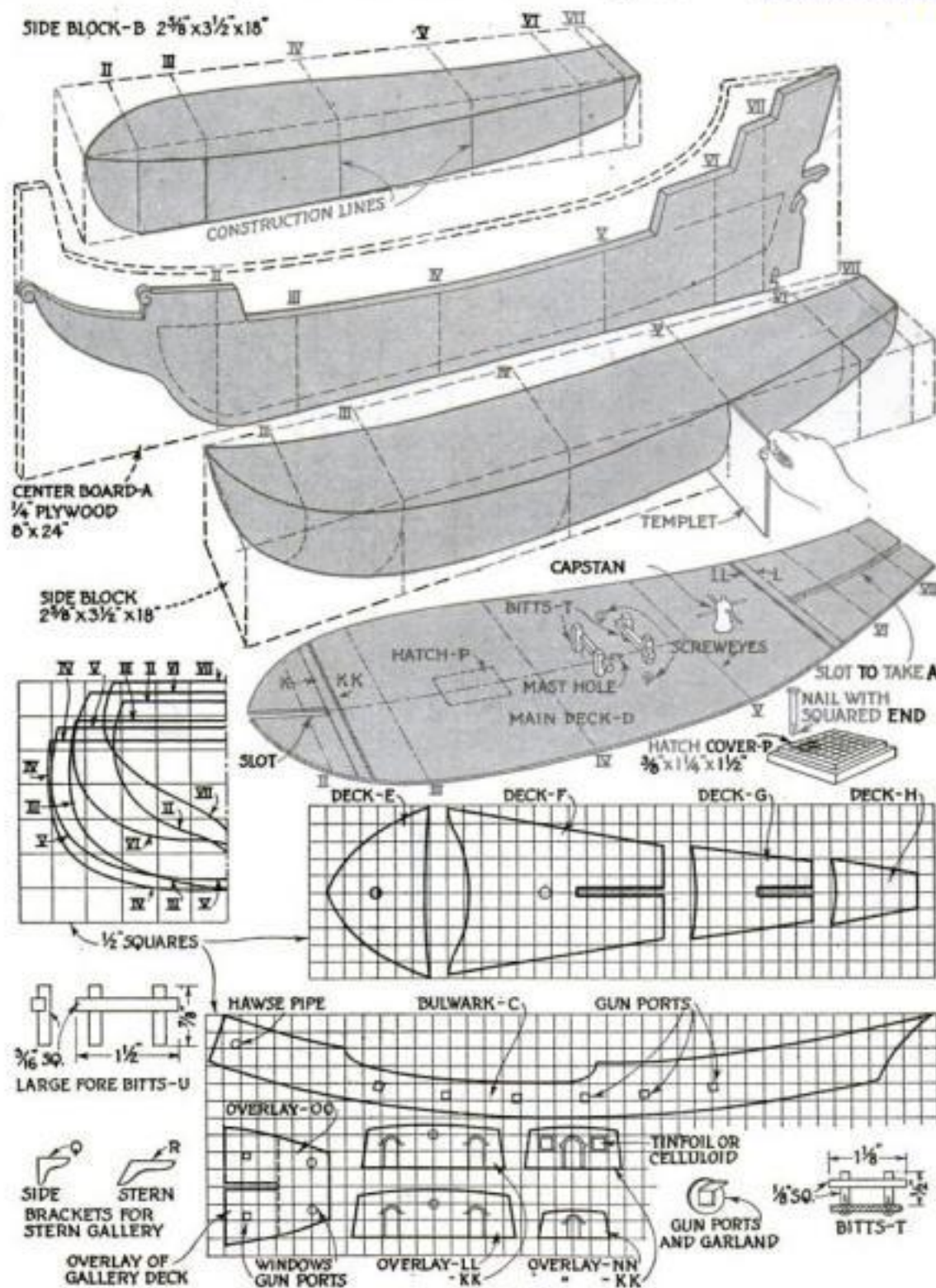


Fig. 2. The center board, the two side pieces and their six section lines, the five decks, the bulwarks and bulkheads, the hatch, gallery brackets, bitts, and gun ports are shown above

The Home Workshop

Blueprints to Help You Build the Galleon on Our Cover

SO MAGNIFICENT in line and color is the Spanish galleon ship model on our cover, that many readers may be inclined to say: "I never could make anything as intricate as that." But this is not at all true.

Anyone who can wield a pocket-knife and paintbrush can make this particular model. It has been designed with that idea in mind—a model beginners can make, yet one the most experienced model maker would recognize as authentic.

It is necessary, of course, to have large, clear drawings, and these you can obtain ready-made by sending for blueprints Nos. 46 and 47 in the list below. No. 46 is for use in connection with the first half of Captain McCann's article, which appears in this issue (page 71), and No. 47 supplements both the first half and the second half, which will be published next month. It will save time if you send for both blueprints at once.

Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.

Popular Science Monthly

250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below for which I inclose.....cents:

No.	Title	Published	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
13.	Tea Wagon	Nov., '22	25c
14.	Christmas Toys	Dec., '22	25c
15.	Workshop Bench	Jan., '23	25c
16.	Inlaid Radio Cabinet	Feb., '23	25c
17.	Cedar Chest	Mar., '23	25c
18.	Phone Table and Stool	Mar., '23	25c
19.	Grandfather's Clock	Apr., '23	25c
20.	Flat-Top Desk	Apr., '23	25c
21.	Colonial Desk	Apr., '23	25c
22.	Cabinet and Desk	Apr., '23	25c
23.	Pergola Garage	May, '23	25c
24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c
44.	Pirate Ship Model—Hull	Feb., '26	25c
45.	Pirate Ship—Details	Mar., '26	25c
46.	Galleon Model—Hull	May, '26	25c
47.	Galleon Model—Details	May, '26	25c

Name.....
(Please Print)

Street.....

City and State.....

Remington

PORTABLE



For Home Writing!

WRITING by hand is out of date. The Remington Portable Typewriter has made it so.

The Remington Portable is ever so much faster, and enables you to make copies of your personal writing without extra effort. It is a necessity of modern, fast-moving life.

Graduation time will soon be here. What finer or more helpful commencement gift than a Remington Portable for the boy or girl who has college or business days ahead!

It is the handiest, fastest, simplest to operate, and most dependable of all portables—and it is the smallest, lightest, most compact portable with *standard keyboard*.

Give yourself more leisure by saving time with a Remington Portable. You can purchase it on terms as low as \$10 down and \$5 monthly from Remington branches and dealers everywhere. Write today for our illustrated booklet, "For You—For Everybody." Address Department 67.

REMINGTON TYPEWRITER CO.
374 Broadway New York
Branches Everywhere

Remington Typewriter Co. of Canada, Ltd.
68 King Street West, Toronto

Remington

TYPEWRITERS

Remington made Paragon Ribbons and Red Seal Carbon Papers always make good impressions



STANDARD TYPEWRITERS



NOISELESS TYPEWRITER

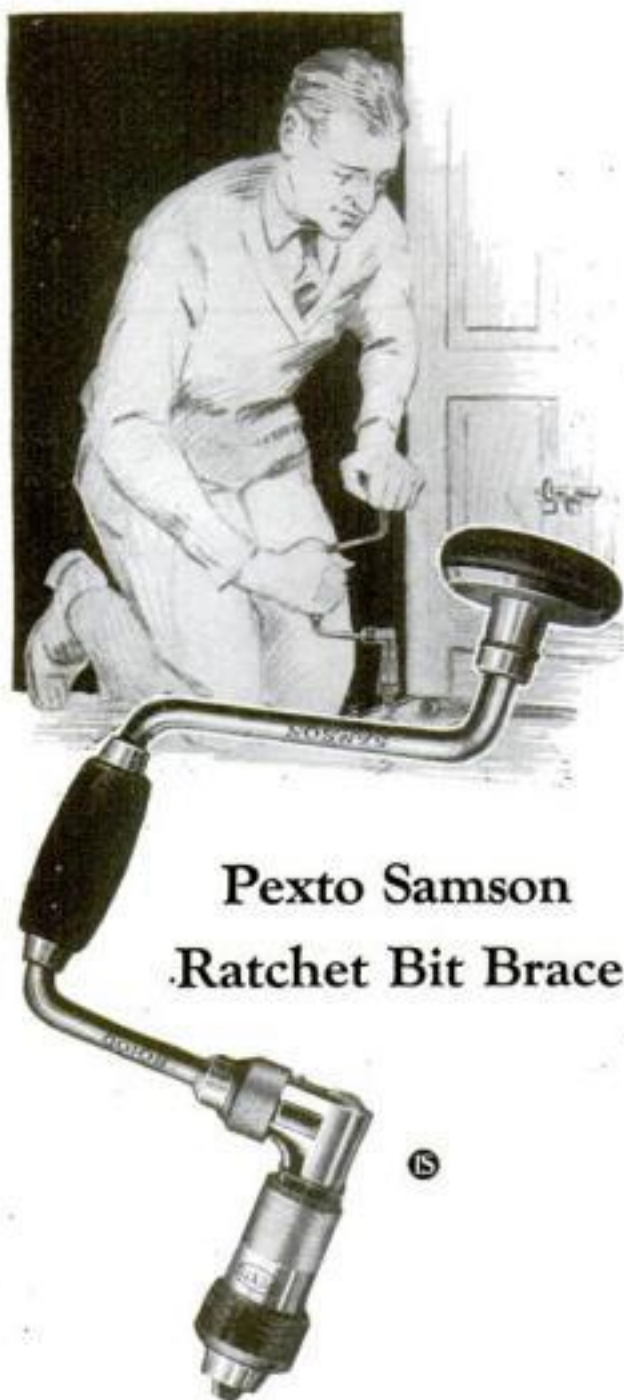


PORTABLE TYPEWRITER



ACCOUNTING MACHINES

A MACHINE FOR EVERY PURPOSE



**Pexto Samson
Ratchet Bit Brace**

FOR the mechanic and for general home use, the Pexto Samson Ratchet Bit Brace, illustrated above, will give a lifetime of dependable service and stand up under the severest 'roughing.' Its ball-bearing chuck gives the Pexto Brace a grip that never lets go. It will hold round, square or taper-shank drills. The Samson is the kind for you—it's a boon to the "home mechanic."

PEXTO TOOLS are carried by practically all progressive dealers.

The Peck, Stow & Wilcox Co.
Southington, Conn., U. S. A.

PEXTO
Worth While
TOOLS

The Home Workshop

You Can Make This Galleon

(Continued from page 88)

the after end, to be trimmed when in position.

Steam the forward 6 in. of these pieces (unless cardboard is used) and glue and nail them to the hull, overlapping it $\frac{1}{4}$ in. A rough block of scrap wood glued in the stern (Fig. 3) is helpful for nailing into. Note how this bulwark follows the "tumble-home" or inward slope the hull started.

On the deck erect the bulkheads K and L (Fig. 5) of $\frac{1}{4}$ -in. plywood. K stands $1\frac{1}{4}$ in. high and slants forward a trifle; L is $1\frac{3}{8}$ in. high and leans aft. Cut both to fit between the bulwarks and bevel to meet the slope to the deck.

Cut the decks E and F (Fig. 2) from the $\frac{1}{16}$ -in. plywood and glue on so as to overlap the sides about $\frac{1}{8}$ in. If the tops of the bulkheads are rounded to about $\frac{1}{8}$ in. higher in the center than at the ends, that will give the decks a slope or camber, which is realistic and looks well.

When in position the poop sides should leave a promenade deck about $\frac{3}{8}$ in. wide on either side of deck F.

As a protection for this promenade we shall need a handrail (Fig. 8). This is a strip of wood about $\frac{1}{16}$ by $\frac{3}{16}$ by $6\frac{1}{2}$ in. Bore fine holes along it at $\frac{1}{2}$ -in. intervals, drive small bank pins through these, and on each drop three or four beads, with a touch of glue to keep them in place. Then bore holes in the deck to correspond.

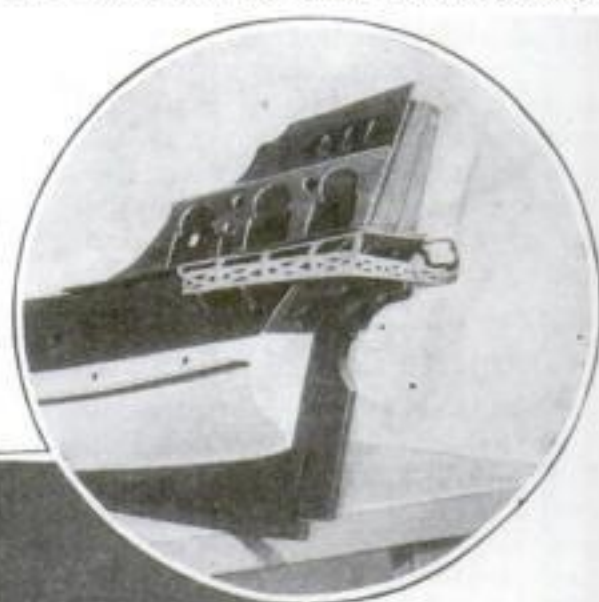
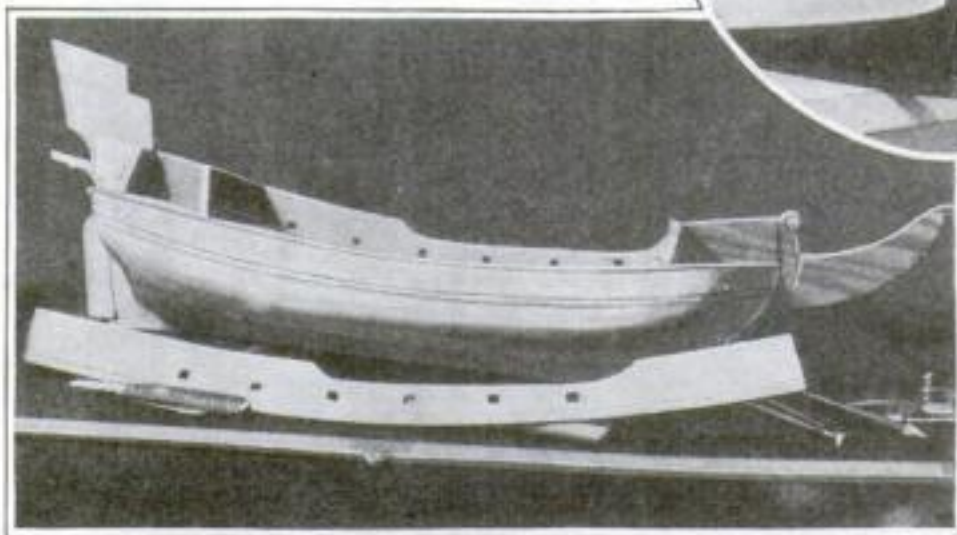


Fig. 3. (At left) Center piece, side blocks, one bulwark, and two bulkheads in place, with filler blocks in the stern. Fig. 4. (Above) The high stern with ornamental overlay and Admiral's gallery.



Erect bulkhead M, deck G, bulkhead N, and deck H, similarly.

The overlays which cover the exposed faces of the bulkheads are of very thin wood (veneer), or cardboard painted to look like it. Doors and windows are cut in these. Door paneling is painted on and the windows are filled with celluloid, or silver paper.

Sides are needed to enclose these high poop decks. Cut them from thin three-ply stock, with gun ports and windows pierced, as shown in Fig. 6. These pieces also require an ornate overlay.

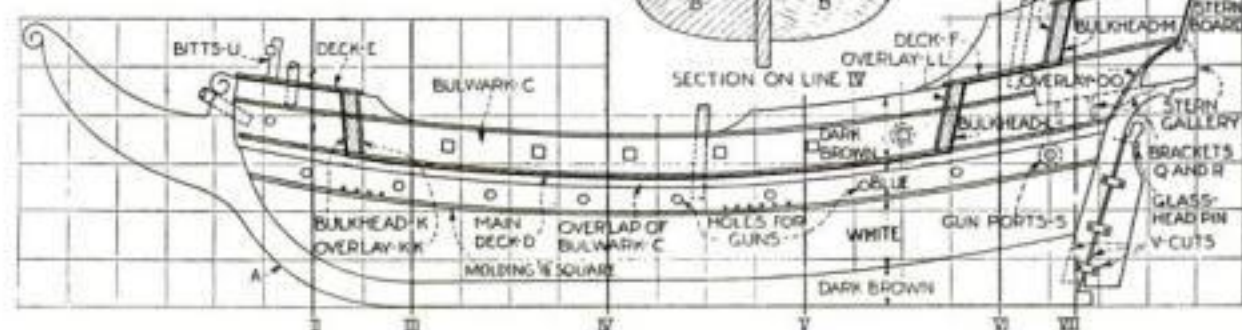
Invert the handrail and tap into position. Cut the projecting pin ends off underneath, or cut them before inserting. Small glass headed pins may be used at intervals. The rail is to be stained and the beads painted silver, but do not put these in position until almost the last thing.

Two similar but much shorter rails will be wanted for the forecabin. Cut or bend them to suit the curve of the bow.

The stern board (Fig. 7), $3\frac{1}{4}$ in. wide and $3\frac{1}{2}$ in. high, is fretsawed from a piece of thin wood.

(Continued on page 91)

Fig. 5. Diagram showing the hull construction on squares, each of which represents 1 sq. in., and a cross section. The heavy line represents the upper boundary of the center board.



The Home Workshop

You Can Make This Galleon

(Continued from page 90)

such as the lid of a cigar box. The windows are pierced and the whole lightly carved. In the center space, put a little picture of something symbolic, which you may paint yourself, or find ready. It may be a sacred picture, a device from a cigar box, or what you please. Perhaps you can touch it up with oil paints; in any case, varnish it well.

The board is glued and nailed on with $\frac{3}{8}$ -in. No. 21 wire brads, a box of which will be found invaluable all through the work.

The figurehead shown in Fig. 7 is cut from a piece of $\frac{1}{2}$ -in. soft wood. Before being outlined with the fretsaw, it is cut down lengthwise as far as to where the line of the stem (piece A) crosses it, so that a $\frac{1}{4}$ -in. slot can be taken out and it can be fitted over A. Lightly carve it, cut away the center with a chisel, and fit it on the cutwater.

Just behind this come the head boards (Figs. 1 and 6). These are cut from $\frac{1}{16}$ -in.

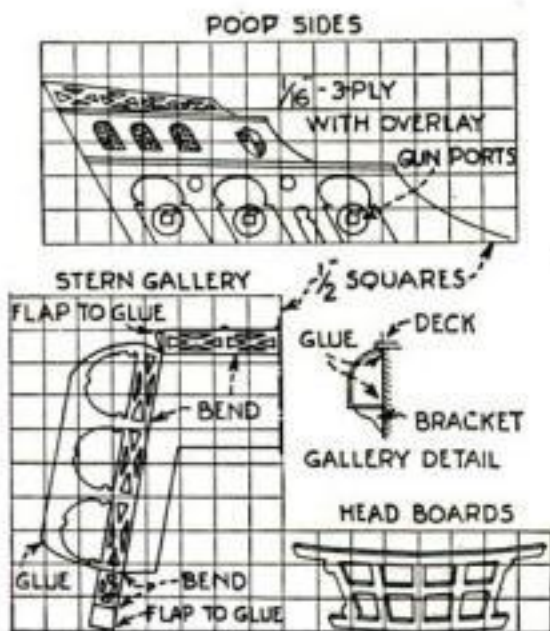


Fig. 6. The sides of the high stern and their ornamental overlays, the pattern for the Admiral's gallery, and the design of head boards, which are bent as shown in Fig. 1

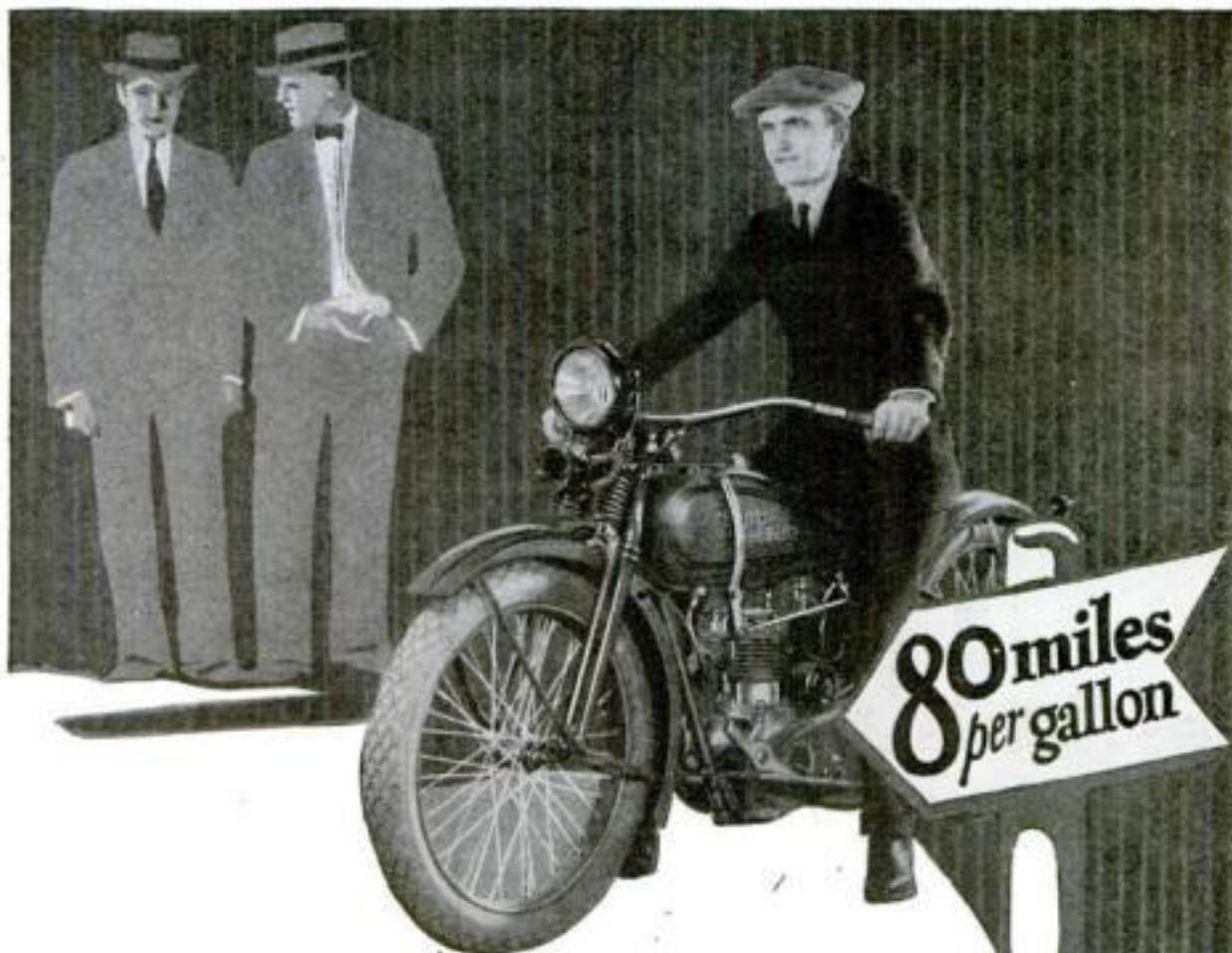
waterproof three-ply stock. The ends are beveled to fit above and below the body of the lion and to suit the cutwater, and the other ends to meet the bulwark. They will need steaming until they can be bent to the right position. Then they are glued and nailed. Other material may be used, as previously indicated.

Across these and lying on them, comes a $\frac{1}{4}$ by $\frac{1}{4}$ by $3\frac{1}{2}$ in. spar (an early form of cathead), over which the anchor cable passes. The spar fits close under the bowsprit, so do not place it until you try the latter.

Before placing the head boards, bore two $\frac{1}{8}$ -in. holes through the cutwater, one under the lion's tail, the other behind it (Fig. 7).

Cut a piece of stiff, flexible cardboard to the shape of the overlay OO (Fig. 2), pierce the gun ports and windows, paint it to look like wood, then glue and nail it on the under part of the stern, to follow the lines of the after part of the bulwarks and preferably inside them. Cut it in the first place a bit

(Continued on page 92)



Lowest Cost Power Travel

80 SAFE, quick, comfortable miles to a gallon of gasoline; 800 miles to a gallon of oil; 12,000 miles from a pair of inexpensive tires — that's low-cost power travel!

— that's average performance for the Harley-Davidson Single [the new-type motorcycle]! Many people who own cars use this lowest-cost personal transportation to and from work, for quick errands and individual pleasure jaunts. No parking or garaging difficulties. Come and go quickly. Any 2 x 8 space will park or house it. Ample power for any road or hill. Safely balanced at all speeds.

Easy to ride [learn in the length of a city block], and easy to pay for. Your Harley-Davidson dealer has a "Pay-As-You-Ride" plan for your convenience. See him.

HARLEY-DAVIDSON MOTOR Co., Dept. PS Milwaukee, Wis.

We want a live dealer in every locality. A money-making opportunity for real workers. If interested, check the coupon.

The
HARLEY-DAVIDSON
[New-Type Motorcycle] Single

HARLEY-DAVIDSON MOTOR COMPANY, Dept. PS Milwaukee, Wis.
Send me free literature about the new Single.
Tell me about your dealer proposition.

Name _____

Address _____

MILLERS FALLS AUTO JACKS Nos. 130 & 145



This is
No. 130

Price

\$7

Balloon Tires?

—Then here's your jack!

A FLAT balloon tire is awfully flat, and only a special jack will go under the axle. Here it is—Miller Falls Balloon Tire Jack No. 130. It's short—but what a reach! Double action gives it 10 1/4" lift. Small—but it will pick up its share of any car. Two ton capacity—but your wife or daughter can operate it easily. Extension handle keeps user out from under the car. At hardware, auto accessory stores and garages—look it over—and ask about it.

MILLERS FALLS COMPANY
Miller Falls, Mass.

28 Warren St., New York
9 So. Clinton St., Chicago
Manufacturers of Mechanics'
Tools, Hack Saws and
Automobile Tools



This is No. 145—
for regular tires. Easy and
convenient operation is a
feature. Extension handle,
quick release device,
adjustable base—strength
and power—and only \$5.
Tubular extension handle
is shown at right of jack
(greatly reduced). 36"
long when fully extended.

**MILLERS FALLS
TOOLS**

SINCE
1868

The Home Workshop

You Can Make This Galleon

(Continued from page 91)

large and trim to fit; this is a good rule to follow in most cases. The lower edge of the stern board overlaps it.

The Admiral's gallery round the stern is cut from thin pressboard, heavy Bristol board, or other good cardboard. It is rather tricky to cut, but should be approximately as shown in Fig. 6.

Try out the center cut until it fits snugly round the stern, when lying on the brackets, of which one is the extreme stern projection of center board A, and the others, Q and R (Fig. 2), are glued and nailed in position, two on either side and two on the stern. When the gallery fits, cut out the fretted parts with a sharp knife, bend up as indicated, bend in the forward ends, glue the flaps, place it on the glued brackets, glue the top edges, and spring them under the edge of deck F. Note the small sectional view in Fig. 6.

The stern lantern is cut from a square piece of soft wood, as shown in Fig. 8. The windows are recessed and filled with silver paper, colored a transparent blue, and painted with diagonal bars. The corner ornaments are belt pins; the center staff is a large pin, which is threaded on a button mold, passed through the lantern, through another round mold,

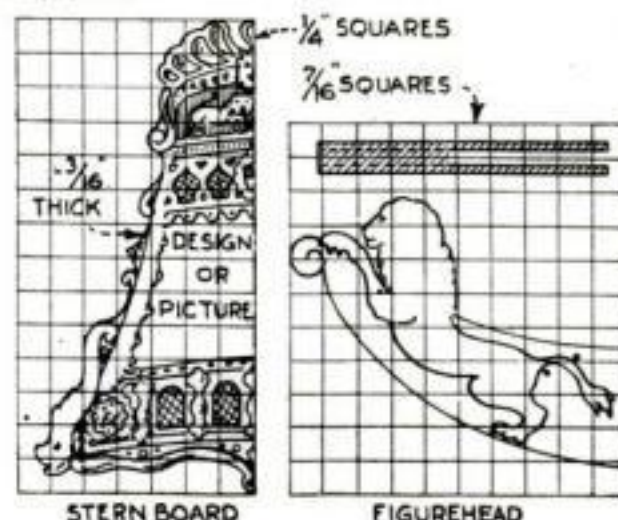


Fig. 7. Half the stern board, and the figurehead, slotted to fit over the cutwater

ders vary with the height of the various decks. You can attach thin brass wire handrails to them, if you wish.

The bitts, one large (U) on the foreside of the foremast, one (T) on either side of the mainmast, and one (T) before the mizzenmast, are made from square sticks either 3/16 or 1/8 in. square as shown in Fig. 2. The cross pieces are recessed into the uprights and glued. The best way to attach the bitts is to glue them to the deck and fasten them with tiny screws from underneath, but that necessitates placing them before the decks are laid down. Another method is to cut holes in the deck, and glue the bitts very firmly into them. In that case, leave the vertical members of the bitts long enough to project into the deck.

At the lower edge of the orlop (lower) deck, there should be fastened a 1/8-in. molding, glued and lightly nailed.

Another molding about 1/16 in. square should be glued in line with the top of the open part of the bulwark, from the stem to the gallery. Some decorations may be painted between this and the top of the bulwark, forward and aft.

Below the lower molding, give the hull two coats of white paint; above it, two coats of light blue, as shown on the cover. The center piece and bulwarks are stained dark oak and all the woodwork then is given one coat of varnish. The surface should not be glossy.

Next month the rest of the fittings and the rigging will be described.

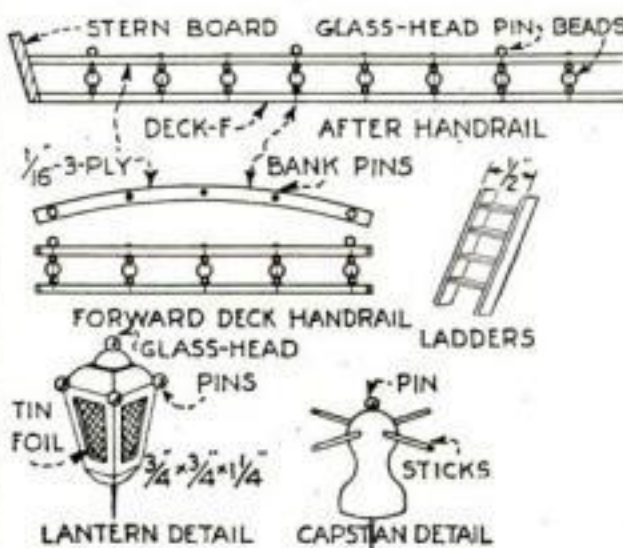


Fig. 8. Details of handrails, ladders, capstan, and lantern. Note the ingenious use of pins and beads all through the design

and then into the top of the stern board.

The capstan (Fig. 8) is wood about 3/8 in. in diameter and 3/4 in. long, cut to the shape indicated. Drill 1/16-in. holes through the head at right angles to each other and pass 1 1/2-in. long sticks through them for the capstan bars. A long pin or thin nail is driven right through the capstan into the deck.

The main hatch (P, Fig. 2) is a block of soft wood, 3/8 by 1 1/4 by 1 1/2 in. The top is punched with the squared point of a large nail so as to represent a grating. The holes later are painted black, as is the lower half of the hatch; the upper part is stained a dark oak color.

The six ladders are made from strips of very thin cigar-box wood glued together. The steps of each ladder must be exactly the same length. The lengths of the lad-

Those readers who live in New York City and the vicinity will have an opportunity to see the original model of the Spanish galleon made by Captain McCann in the window of an art gallery at the corner of Fifth Avenue and 54th Street. The exhibition will be held from April 19 to April 24 and possibly longer. Other models to be shown by Captain McCann will be the pirate model ship of our Blueprints Nos. 44 and 45; the *Torrens*, which was Conrad's last ship; the *Wanderer*, the last American whaler, and two 17th century decorative models.

The Home Workshop

A Hand Planing Machine

(Continued from page 74)

and then a cut washer is clamped under the head of the cap screw.

The screw G has a handwheel, which is used to advance the table. The block H is screwed to the table and the hole for the screw is a free fit to allow for the deflection that occurs as the table rises or falls when the handwheel is turned.

Two blocks, marked I, are made up and fastened to the frame at either side. Between these two blocks is a steel bar 1 in. square, with the ends turned down to fit the $\frac{1}{2}$ -in. holes drilled in the upper ends of the blocks I. This cross-bar then is tapped at the center to take the $\frac{1}{2}$ -in. U. S. S. thread provided on the screw G. This arrangement allows the



Under view of the forward table showing the adjusting ways and spring for taking up play

bar, which acts as a nut, to turn as the screw is deflected with the rise and fall of the table. The construction is shown plainly in the photographs on page 74.

A stiff spring N is arranged to pull the center of the forward table downward. This insures its remaining in close contact with the ways at all times.

The tables, A and B, were made up of $\frac{1}{2}$ -in. plates of machinery steel. It was necessary to place them on the planer and take a light cut. Blocks of wood and grinding compound were used to polish the surface. Emery and oil or a valve grinding compound may be used for the abrasive.

As described previously, the tables are fastened to the ways and rests by means of $\frac{3}{16}$ -in. cap screws. The heads are sunk flush in holes counterbored in the table-top for this purpose. It may be necessary to use shims in order to bring the tables true with the head and knife edges. When the front table is finally brought true with the head, it will require no further shimming, as the raising and lowering of it will not throw it out of parallel.

The construction of the ball bearing head is the feature requiring most care. The bearings used in this instance were salvaged from an automobile transmission. They are approximately $2\frac{1}{2}$ in. in outside diameter and 1 in. in inside diameter. The exact measurements of the bearings must be known before the end plates, or bearing carriers of the head frame, may be bored out. Likewise, the shaft will have to be turned to conform to the actual measurement of the inner cone of the bearings. It may be necessary to change the general plan of mounting the *(Continued on page 94)*

An article on Simple Pocket Knife Carving will appear in an early issue.



In love affairs always second best

She had been explaining palmistry to both of them; but when it came to a demonstration she held his rival's hand, not his: "Nothing to worry about," he thought bitterly to himself, "except that I can't understand why it is *always* like this." Always in love affairs, he came off second best.

A great many young men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

Clears the Skin. Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use. After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the dirt and skin impurities. Result—a clean, healthy skin with clear, glowing color.



Use Pompeian Massage Cream regularly at home—then you'll get the full benefit. At all druggists.

SPECIAL INTRODUCTORY OFFER

$\frac{1}{3}$ of 60c jar for 10c



For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits. Positively only one jar to a family on this exceptional offer.

THE POMPEIAN CO., Cleveland, O., Dept. 47
Gentlemen: I enclose a dime (10c) for $\frac{1}{3}$ of a 60c jar of Pompeian Massage Cream.

Name

Street Address

City State



®

"ATKINS" —A "Lifetime" of Saving!

SAVE time—save labor—save material—save money in YOUR home with an ATKINS No. 53 Home Saw! "Silver Steel" makes it outlast two or three "cheap" saws. "Taper Grinding" makes it cut faster and easier.

Ask for our interesting folder "Saws in the Home" or information on better saws for every use.

E. C. ATKINS & CO.

Established 1857

Leading Manufacturers of highest Grade Saws for Every Use; Saw Tools, Saw Specialties, Planing, Trussing, and Machine Knives

INDIANAPOLIS, U. S. A.



ATKINS SILVER STEEL SAWS

The Home Workshop

A Hand Planing Machine

(Continued from page 93)

bearings. The simplest possible idea is indicated in the drawing. It is a good plan to arrange the construction to exclude all dust and dirt. This is usually a matter of providing felt and dust washers of thin metal on each side of the bearings. These appear in the finished machine, but not in the drawing. The head and the shaft were constructed from one piece of 3-in. machinery steel. After the bearings were on hand, the ends were turned to the proper diameter and shouldered as indicated in the drawing.

The knives were made from tool steel. This was purchased in strips $\frac{1}{8}$ by 1 in. and cut to length. It was hardened between steel plates which kept it in a plane. The temper of the blades was drawn to between a straw and purple. The knives were finished to about $\frac{3}{8}$ in. wide by grinding. It might be possible to obtain the tool steel already hardened and tempered.

THE chip breakers are sheet steel $\frac{1}{16}$ in. thick. The grooves, which are $\frac{3}{16}$ in. wide, are provided with a rake of 15 degrees, which seems to be about the angle generally given jointer knives. Chip breakers and knives are held in position by means of safety head setscrews.

The head may be grooved in the shaper, miller, or planer. When set up for this operation the cylinder is slightly relieved just ahead of the chip breaker.

The construction of a square head would have been easier, but the one shown conforms to safety head practice.

The rear table is provided with a groove or rabbet. This is to facilitate the cutting of rabbets in lumber.

One end of the head carries the belt pulley, and the other end is left long, in case it is desired to mount a special cutter knife or a small grinding wheel. If this is definitely planned, it would be well to turn on threads and provide collars for mounting a $\frac{3}{4}$ by 6 in. stone.

A simple fence, C, may be made from a piece of $\frac{1}{2}$ by 4 in. cold rolled steel mounted on short blocks, D, of the 1 by 3 in. stock. These are clamped to the rear table and a row of holes drilled across the table allows the fence to be moved.

Sliding Rest for Hand Grinder

TO MAKE it easier to sharpen plane bits and chisels on my hand grinder, I bored a hole end-wise through the tool rest and then made a clamp to slide over the wheel as illustrated. The plane iron or chisel may be clamped on this sliding rest to get any bevel desired. It is also possible to tip the tool back to inspect the edge without removing it.—A. C. BRUNDAGE.



You Need This!

It's the Easiest Way to Fix Punctures

You can't help but make a perfect puncture repair with this handy little Shaler 5-Minute Vulcanizer—it's so simple and easy to use. In an emergency, when you get stuck on the road with a "flat," you can depend on it to make a heat-vulcanized repair that will last, in just a few minutes.

The Shaler costs so little that you should carry it in your car—always. After you use it once you'll know why motorists used fifty million Shaler patches last year.

Complete outfit includes vulcanizer and 12 Patch-&-Heat Units. You can get it wherever auto supplies are sold for only \$1.50. Slightly higher in Canada and far West.

C. A. SHALER CO.

Waupun, Wis., U. S. A.



or choice of 44 styles, colors and sizes in the famous Mead line of bicycles to keep and use a month as your own. **Would You** then agree to show your bicycle to ten or more of your friends and tell them the ridiculously low factory price, easy terms, unusual conditions and exceptional offers we would make, all of which we will explain to you if within ten days of seeing this you will say in a letter or on a postal, "Send particulars of Bicycle Offer" and address your postal card or letter to **MEAD CYCLE CO. Dept. D250 Mead Block, Chicago**

BUY DIRECT
SAVE HALF
GRADE A
QUALITY
GOODS
at WHOLESALE

SEND FOR FREE BOOK

Any handy man can install his own plumbing and heating by our new, easy method. Free installing plans show you how. You save waste and high labor cost with our cut-to-fit system. Fifty years of economy service to home owners, farmers, builders and mechanics. Million dollar plants behind our guarantee. **FREE BOOK** shows everything in plumbing and heating fixtures and supplies. Write today for copy.

HARDIN-LAVIN COMPANY
106-16 West Pershing Road, Chicago, Ill.

WADE BENCH LATHE

Cap., 4 in. dia. x 12 in. length, slider rest has travel entire length of bed, lead-screw inside bed, follow spindle. Turning, facing, boring, drilling, winding, thread cutting.

No. 1 Lathe, plain headstock \$28.00
No. 2 Lathe, back-gear headstock \$58.00

Complete line of accessories at equally low prices. Catalog sent free.

THE GEROLD COMPANY
Dept. P. S. 11, 120 Liberty Street, New York

The Home Workshop

Cheaply Improvised Wood-Lathe

By OWEN LOVEJOY

HOW I made a serviceable little wood-turning lathe at an expenditure of \$3 is shown in Fig. 1. The only thing purchased was the small polishing head; the motor was taken from a discarded vacuum cleaner. The lathe has proved to be powerful enough, nevertheless, to turn out any job within the scope of my home workshop.

The first part to be made was a sliding member of wood. This is clamped in a

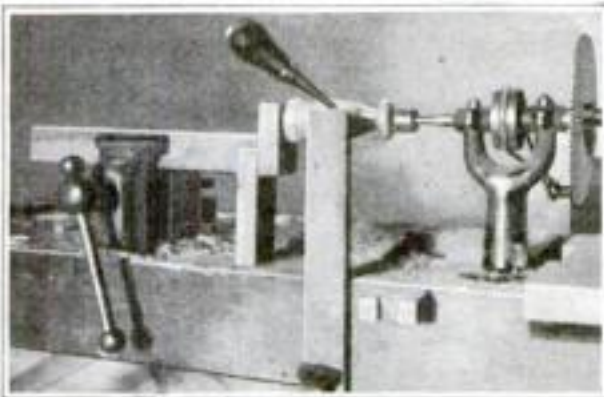


Fig. 1. Inexpensive polishing head converted into a lathe for turning work between centers

vises at the left of the polishing head and allows different lengths of wood to be turned.

To this tailstock was fitted a vertical foot, which determines the height of the dead spindle on which the work rotates. For this spindle a long, stout wood screw was set right through the vertical block, after its tip had been pointed smoothly on a stone.

A short piece of broom handle then was sawed off and bored so that it could be screwed on the live spindle. The end of the spindle projected far enough beyond this piece to fit into a central hole in the end of the work to be turned. To engage the end of the work positively, two finishing nails were inserted in the section of the broom handle and cut off with a hacksaw about $\frac{1}{8}$ in. beyond the end of the broomstick.

An upright member to support the turning tool was clamped to the edge of

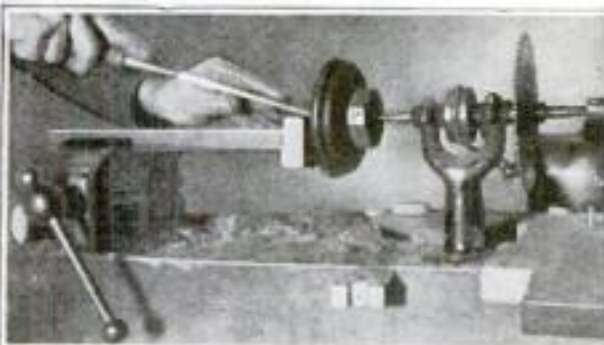


Fig. 2. The same homemade lathe set up for turning relatively flat work on a faceplate

the bench with a large C-clamp. A hand-screw, of course, could be used instead.

When the work is set up in the lathe, the screw that forms the dead spindle is tightened into the wood by means of a screwdriver. Thus vibration is practically eliminated.

(Continued on page 96)



The Telephone and Better Living

PICTURES of pre-telephonic times seem quaint today. In the streets were horses and mud-splashed buggies, but no automobiles and no smooth pavements.

Fifty years ago homes were heated by stoves and lighted by gas or kerosene lamps. There was no domestic steam heating or electric lighting, nor were there electric motors in the home. Not only were there no telephones, but there were no phonographs, no radio and no motion pictures.

The telephone permitted the separation of business office from factory and made possible the effective co-ordination of widespread

activities by a centralized organization. It changed the business habits of the Nation.

The amazing growth of the country in the past fifty years could not have come had not science and invention supplied the farmer, manufacturer, business man and family with many new inventions, great and small, for saving time and labor. During this period of marvelous industrial progress, the telephone had its part. It has established its own usefulness and greatly accelerated the development of the industrial arts which have contributed so much to better living conditions and to the advancement of civilization.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES



IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

Make More Money

Read the Money Making Opportunities on pages 116 to 142 of this issue.

"World's Handiest Calculator"

(NEW POCKET SIZE)

ADDS	SUBTRACTS	MULTIPLIES	DIVIDES
------	-----------	------------	---------

NEW Will do the work of a large \$300 adding machine. Capacity 99,999.99. Total visible at all times. Clears with pull of the finger. NOT A TOY, but an indestructible portable machine GUARANTEED five years. So compact that it fits in vest pocket. Accurate. So simple a child can operate it. Instructions with every machine. Everybody should carry one for figuring as it is suitable for any use where numerals are dealt with.

FREE TRIAL : **SEND NO MONEY**

Just write "Send me a Baby Calculator" and give your name and address. We will ship Calculator immediately. On delivery pay postman \$2.50 plus few cents postage. (\$3.50 cash outside U.S.). If not satisfied after 10-day trial, you get your money back. THOUSANDS OF SATISFIED USERS. This is lowest priced practical portable calculator made. "Why pay more for inferior imitations?" Order from this ad today.

BABY CALCULATOR SALES CO., P. O. Box 1118, Chicago, Ill.

\$2.50

TOTAL COST

AGENTS: Every business firm, man or woman will buy this machine on sight. BIG COMMISSIONS. Dept. 50.

Make big money from repair work



Practically every household spends at least \$10.00 to \$50.00 each year and many spend several times that much on simple repairs that can be made *quickly, easily and well* with

Smooth-On No. 1

By keeping a can of Smooth-On handy, you can save this money in your own home—and by doing similar repair work for others, you can make money.

No skill is required to make repairs, and the amount of Smooth-On used on any one job seldom costs more than a few cents.

Typical repairs that can be made perfectly with Smooth-On:—

Stopping leaks in steam, water, gas, oil or stove pipes, mending cracks, breaks or leaks in furnaces and boilers, radiators, tanks, sinks, pots and pails, making loose handles tight on umbrellas, knives, hammers, brushes, drawers, etc., tightening loose screws, hooks, locks, door knobs, etc.

On the Automobile:—Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, tightening loose headlight posts, keeping grease cups, hub caps, and nuts from loosening and falling off, etc.

To get perfect results, write to us for and use the Smooth-On Repair Book. Free if you return the coupon.

Get Smooth-On No. 1 in 7 oz., 1-lb. or 5-lb. tins at any hardware store or if necessary direct from us.

Smooth-On Mfg. Co.

Dept. 58, 574 Communipaw Ave.
JERSEY CITY, N. J.



Write for
FREE BOOK



Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....
Address.....

**Return this coupon for a
FREE copy of Booklet**

The Home Workshop

Cheaply Improvised Wood Lathe

(Continued from page 95)

Fig. 2 shows the operation of a simple faceplate for flat work, such as small trays. It was made by drilling an octagonal block of hard wood to screw on the spindle of the polishing head, so that the spindle projects about $\frac{1}{8}$ in. beyond it to center the piece being turned. Through this block were set two rather heavy wood screws, long enough to project into the work about $\frac{1}{4}$ in.

In use, this plate is screwed first to the piece for turning, after a small hole has been made in the latter to center it on the spindle.

For a tool rest with this device, the adjustable sliding member of the first illustration is turned on its side in the vise.

It is really surprising what can be done in the way of turning small novelties and furniture ornaments by these simple means.

In Fig. 3 is illustrated an improvised drill chuck that the writer has used in drilling both woods and metals. It saves a vast amount of tiresome hand work.

A section of broomstick was drilled out to screw on the opposite end of the polishing head from the lathe. Then, by means of a $\frac{1}{4}$ -in. wood chisel, the other end of the broomstick was turned hollow and tapering while the spindle was rotating. The chisel was rested on a suitable sup-

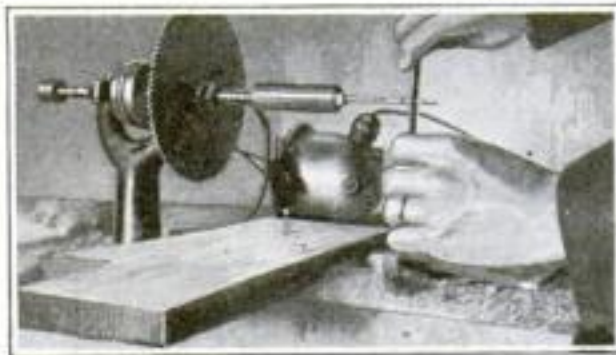


Fig. 3. How the polishing head is fitted with a broomstick chuck to serve as a drill

port while this was being done. Into this tapering hole, which was, of course, precisely in line with the axis of the spindle, the square base of a bit-stock twist drill was driven firmly, care being taken not to split the broom handle. With a little care the bit was centered nicely, and by it the writer has drilled as large as a $\frac{1}{4}$ -in. hole in strap steel.

Since the piece drilled was held in the hand as shown, a precautionary measure was used not indicated in the illustration. A stout wire was looped to form a ring around the drill bit, and bent sharply so as to fit through a small hole drilled through the middle of the section of broom handle. Though the bit never showed a tendency to fly out of its chuck, this wire guard made such an eventuality impossible.

It is evident that with this drill, a hole to be drilled in iron must first be marked by a sharp blow with a punch.

Mr. Lovejoy uses the same polishing head for sawing. Next month he will describe the homemade saw table he made to aid in doing accurate and speedy ripping and cross-cutting.



This Year—Make it a Real Vacation

JUST an ordinary rowboat—and the Super Elto! Then you have a powerful launch—giving you thrilling, foaming speed—taking you where the big fish wait—furnishing the finest sport in the world for the entire family. The Super Elto is compact—carries snugly on the running board of any car. Light—merely a “one-hand” carry.

EASY STARTING! Even a child can start the Elto. Starts on the quarter-turn flip of the fly wheel! **Genuine easy starting**—the most vital single quality ever built into an outboard motor. **RELIABLE!** New Super model gives $\frac{1}{2}$ more power—same weight and price. Write for new 1926 catalog—intensely interesting!

ELTO OUTBOARD MOTOR COMPANY
Ole Evinrude, President
Dept. W Mfr's Home Bldg., Milwaukee, Wis.

Super Elto

SEND NO MONEY

Genuine Full Cut Diamonds No Chips
Terms If Desired—6 Months to Pay. Outside U. S. Cash with Order



No. 6132—Solid Gold Men's Initial or Emblem Ring. 2 Genuine Diamonds \$25
4-100 each. 14-Kt. White Gold Top. Gold Emblem (any Lodge) or any initial (Old English), yellow or white Gold, inlaid in Genuine **HOPE RUBY** Also, in Black Onyx

No. 6598—Any initial (raised gold) or Eastern Star, Rebecca, Mason, Shrine, K. of C. emblem (instead of initial if desired). Send number of ring, size of finger, initial or emblem desired and ring will be sent for inspection.
Ask for Free Catalog
Buffalo Jewelry Mfg. Co.
“The Mail-Order House”
Dept. A
501 Washington St., Buffalo, N. Y. White Gold.

No. 6598—Ladies' Ring. Genuine Black Onyx with Genuine Full Cut Diamond. 14-Kt. \$15

ADDING MACHINE

Fits Vest Pocket

SEND NO MONEY
Don't send money, just name and address. Pay postman only \$2.95 plus few cents postage. Try it for 10 days. Your money back if not satisfied.

Counts 1 Billion
Results in plain sight all the time—clears instantly. Made of steel and brass, in handsome case, fits vest pocket; weight only 3 oz. Send for yours now—you'll save time and money.
Reliable Adding Machine Corp., Dept. 155
184 W. Washington St., Chicago, Ill.

AGENTS
Here's a dandy chance to make money. Everybody wants one. Fine profit. Write for new offer.



Catch Fish Eels, Mink, Muskrats and other animals in large numbers with our new folding galvanized **STEEL WIRE TRAP** It catches them like a fly trap catches flies. Write for our **FREE TRAP OFFER**, Bargain Catalog of Fishing Supplies & Formula on best Bait known for catching all kinds of fish. **WALTON SUPPLY CO.** Dep. 19 St. Louis, Mo.

The Home Workshop

Be Your Own Decorator

(Continued from page 72)

In another container a little of the burnt sienna was also mixed with the glazing liquid to the desired tone.

In starting the stippling, the first step was to prime the undercoated wall with a thin coat of clear glazing liquid, doing about a yard and a half width of wall at a time, from ceiling to floor. The tinting liquid then was brushed on generously.

IN THE living room, the ivory drop black and the burnt sienna were applied simultaneously, using a different brush for each color—the black, which was the predominating color, being applied to a larger area, and the sienna being spotted in at intervals and in varying sized spots. In applying, the colors were run together somewhat and blended with the brush so that one color would go into the other softly.

The stippling was done with a cloth, crumpled and held loosely in the hand and constantly changed to present a clean surface of the cloth to the paint.

The texture of the effect in work of this kind is governed by the cloth used. Soft old gingham is usually desirable, while cheesecloth is generally undesirable, as it does not have sufficient body. With some effects, where a coarse texture is preferred, burlap is used. By a twisting and lifting motion, beautiful scrolls are produced. By twisting the hand without any side motion, a rosette or flowerlike effect is obtained, while a sweeping side movement produces a more branching pattern.

The dining room was done in the same way, with the colors selected, and a stencil border design was applied later to set off the effect.

SOMETIMES a "blended" effect is produced so that the walls will be very light at the top, growing gradually darker toward the bottom, where there is considerable depth of color. This is produced by tinting a batch of glazing liquid to the tone desired at the bottom, then pouring off about half of the mixture into another container and adding an equal part of clear glazing liquid, to give the light effect desired at the top.

The light mixture is brushed down about two thirds of the way; the dark mixture brushed up about one third of the way, carrying the color well up into the lighter color. The light and dark mixtures are blended together by brushing back and forth. Stippling is started at the top, working down into the darker color.

A few experiments on a piece of wall-board or even on heavy wrapping paper will reveal the many possibilities.

It will be seen that there is much room for working out individual effects in "Tiffany" decoration, through modification of tone and texture, so that the completed effect may be made to represent one's individual taste.

Sponge stippling, which is another easy method for the home decorator, will be described by Mr. Elliot in an early issue. You'll want to try it, too.

Only the Auto-Set has this time-saving feature

HERE is a Sargent feature found in no other plane. The cutter of the Auto-Set may be removed, sharpened and replaced *without changing original adjustment*. If you are now using any other plane, you can imagine how much time and trouble this saves. Furthermore, despite the simplicity of its arrangement, the cutter of the Auto-Set never chatters, even when you are planing across or against the grain or over knotty surfaces.

For the smaller jobs, you need the Sargent Steel Block Plane. This is as carefully made and finished as the Auto-Set. Its cutter, as in every Sargent plane, is of durable chromium steel.

Both of these planes should be on every school and home work-bench. They are professional tools through and through—yet they are most moderately priced. See them at your hardware dealer's and write us for descriptive booklets.

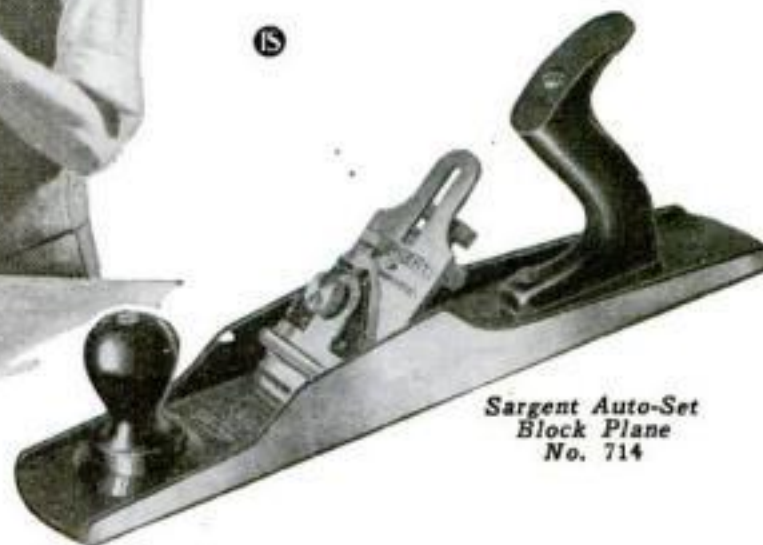
SARGENT & COMPANY, Manufacturers

50 Water Street

New Haven, Conn.



Sargent Steel Block Plane No. 5206



Sargent Auto-Set Block Plane No. 714

SARGENT PLANES

\$100 DOLLARS IN CASH PRIZES

See Page 4 in front of book for details

Buy Now
Pay Later

Let Boice Help You Build It!

No matter what you want to build, Boice can help you. He'll send you the

Boice-Crane Handisaw

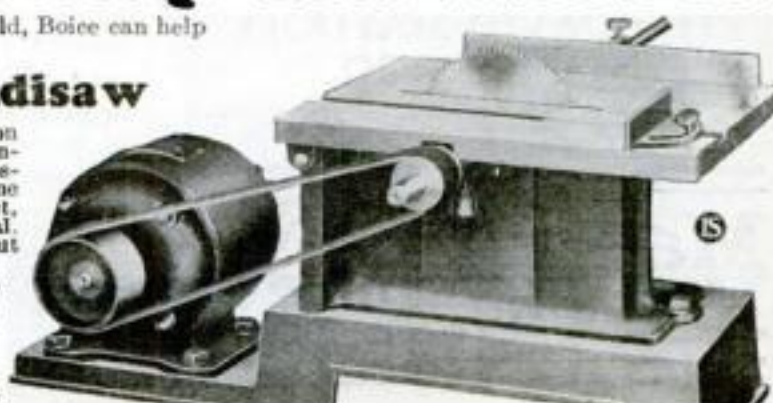
or any other Boice-Crane machine on monthly payments. He gives you unsurpassed prices and values with a positive money-back guarantee. Machine shown will saw, sand, grind, miter, rabbet, tenon, etc. Sturdy, accurate, economical. Saws 1½-inch stock. Sold with or without motor.

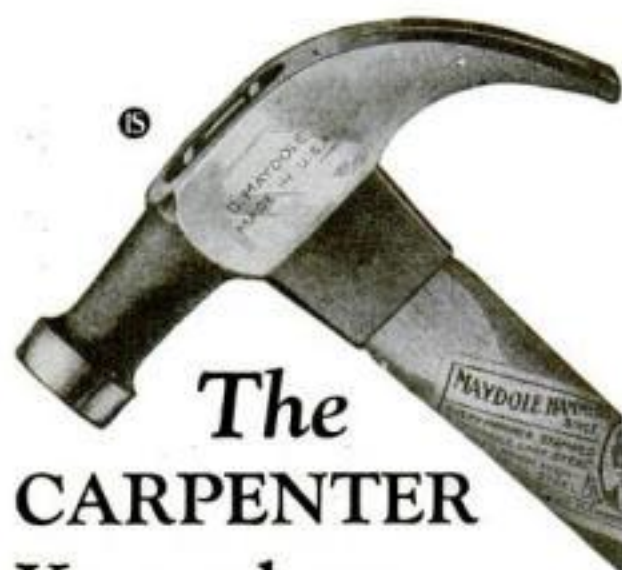
Write today, for Descriptive Catalog of Bench Saws, Drills, Jointers and Band Saws and the Boice E-Z Pay Plan.

W. B. & J. E. BOICE

Dept. P. S. 5-B,

Toledo, Ohio





The CARPENTER Knows hammers

He says: "No job is too tough for a Maydole. It'll stand any amount of punishment. And it's got a 'hang' that helps you get the most out of every stroke without tiring your arm."

"You never see a Maydole with a loose head, a chipped face or a broken claw. That's because it's made *right*. No trick 'features.'—Just a real hammer."

The Maydole Hammer is backed by eighty-four years of specialization in fine hammers. Head is press-forged of tool steel tempered separately at each end. Handle is of clear second growth hickory, air-dried for years.

Your dealer will gladly show you the genuine Maydole Hammer in any of the following types:

Nail Hammers
Ripping Hammers
Machinists' Ball Pein Hammers
Automobile Hammers
Brad Hammers
Farriers' Hammers
Engineers' Hammers
Riveting Hammers
Tinners' Hammers
Patternmakers' Hammers
Bricklayers' Hammers, etc.

Write for Catalog and useful Pocket Handbook 23-B.

THE DAVID MAYDOLE
HAMMER CO.

NORWICH

NEW YORK 9045



The Shipshape Home



How to Patch Damaged Plaster

Easy Way to Conceal Cracks and Blemishes in Walls



Cut out the broken plaster (upper view) and moisten edges thoroughly with water (lower)

By F. E. TUSTISON and
O. P. SCHELLINGER

CRACKS and holes are common blemishes in the average plastered wall. These do not always indicate that the plaster is old and worn, for even new work is likely to have ugly cracks at the corners if the house settles unevenly. A nail, picture hook, or the continual bumping of chairs, toys and other objects often cause unsightly holes. These small defects are easily repaired by one who takes pride in keeping his home shipshape.

All loose material should be removed before any patching is attempted. With a broad knife or putty knife, scrape out the broken plaster until a solid foundation has been obtained.

Cut any small cracks a little deeper so as to provide ample opportunity for the new plaster to adhere to and interlock with the old material. If the edges are undercut, the patches will hold better.

With a small brush or sponge, wet the surrounding plaster. This is to help the newly applied material to stick and to keep it from setting too rapidly. A second wetting immediately before applying the plaster is desirable.

Special patching plasters are recommended for the amateur. These plasters can be obtained in small packages at



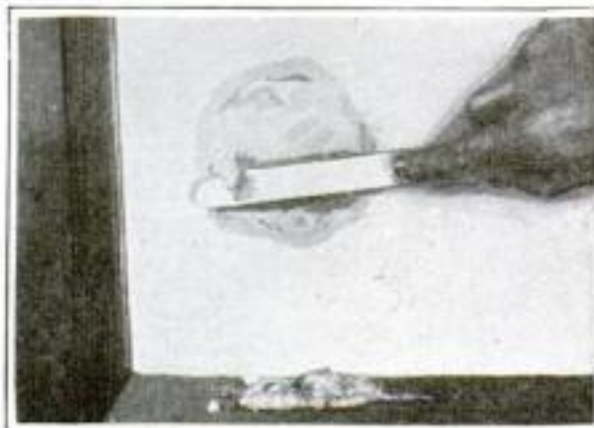
The patching plaster is mixed with water (upper view) and then applied with a trowel

hardware or paint stores. They do not set rapidly, will not shrink to any considerable degree, and often contain the sizing that otherwise would have to be applied separately before any decorating could be done.

Plaster of paris alone is used extensively by the trade for patching small defects. The mechanic mixes a small amount with water and then proceeds to work it off his hands into the crack with a small trowel or putty knife, wetting the surface in order to trowel it perfectly smooth for decorating. The objection to plaster of paris is that it sets rapidly and shrinks away from the old plaster at the edges. A better mixture is two parts of plaster of paris

and one part of hydrated lime, mixed with thin glue or decorators' size. Cement colors may be mixed readily with plaster for repairing a colored wall.

The plaster can be mixed in a dish or, better, on a flat pallet of some kind. The plasterer would probably mix a



If a trowel is not at hand, a kitchen knife, spatula or an ordinary putty knife will serve

(Continued on page 99)

The Shipshape Home

(Continued from page 98)

small amount quickly on his "hawk."

A simple hawk can be constructed in a few minutes from thin box material and part of a broken hammer or hatchet handle or a broomstick. It is well worthwhile to make one such as that illustrated if much patching has to be done, as when the cracks between a number of sheets of plaster wallboard have to be filled.

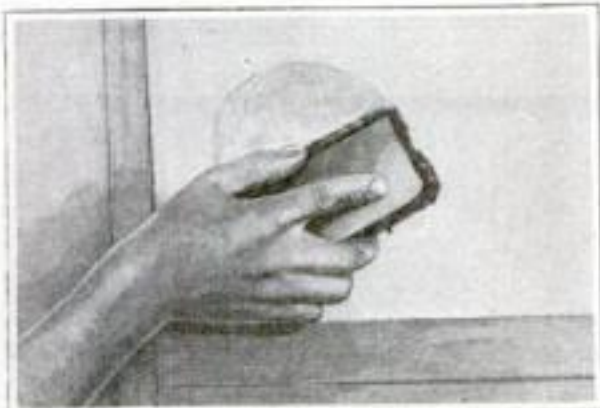


For holding plaster

If the commercial patching plaster is used, add water slowly and mix with a large spoon, or work the mixture with a small trowel or table knife, until a stiff mixture is obtained.

With a small trowel or table knife, plaster the mixture into the hole until it is flush with the surface. Hold the receptacle or hawk below the opening to keep the excess from dropping to the floor.

For a smooth finish, dip the trowel into water and stroke to an even surface. For



To match the various rough plaster finishes, rub the patch with a carpet-covered block

a rough finish, use a block covered with a piece of old velvet carpet. Dip the block into water and rub down with a rotary motion.

With extremely large breaks, it will be found better to make a two-coat job. Apply the first coat over the lath and fill almost flush with the surface. Allow this to harden, and finish with a second coat, which may be troweled smooth or rubbed rough, as desired.

Tamper for Cement

FOR LAYING cinder beds for concrete walks and in doing various kinds of

work with cement, the home owner often needs a heavy tamper. One can be made very easily from heavy wooden blocks, such as the cuttings from floor joists, which can be obtained for the asking

almost anywhere from a frame building under construction. Select a straight-grained piece of hard wood for the handle and nail the blocks on as illustrated, so that each block runs at right angles to the one above. Use plenty of large nails.



Wooden tamper for leveling a cinder bed

SIMONDS

CIRCULAR SAWS PLANER KNIVES



GOOD TOOLS STOP WASTE

Continuous production is dependent upon good tools—tools that last—tools that do not lose their cutting edges in hard service. The name Simonds on cutting tools is a guarantee of dependability—of quality born of a near century's experience in making cutting tools of specially treated steel. Next time—specify Simonds

SIMONDS SAW AND STEEL COMPANY

"The Saw Makers"

Established 1832

FITCHBURG, MASS.

Branch Stores and Service Shops in Principal Cities

A new Parks!

Cabinet Shop Special

No. 10

\$290



You ought to have this handy Parks in your shop!

A compact, complete machine designed just like a big production outfit at one-fifth the cost. Nothing extra to buy. Motor is included, operating from any light socket. Fits in a corner of your basement. Does any kind of cabinet and joinery work. Circular saw, jointer and bandsaw on permanent all-steel frame. Add lathe, shaper and other attachments at small cost. You can make money with this Parks! Write for circular.

The Parks Ball Bearing Machine Co.

1547 Knowlton St., Cincinnati, Ohio

Canadian Factory: 280 Notre Dame East, Montreal, Canada

PARKS
WOODWORKING MACHINES

Makes a Man Wish He Had Two Chins

Barbasol produces such a silky shave. And easy—well! No brush. No rub-in. Just the blade and Barbasol. You try it—three times—according to directions. 35c and 65c tubes.



Name.....

Address.....

P-8-M-5-26

For Modern Shaving



"He deposits \$500 a month"

"SEE that man at the receiving teller's window? That's 'Billy' King, Sales Manager for The Browning Company. Every month he comes in and deposits \$500."

"Three years ago he started at Browning's at \$25 a week. Married, had one child, couldn't save a cent. One day he came in here desperate—wanted to borrow a hundred dollars—wife was sick."

"I said, 'Billy, I'm going to give you something worth more than a loan—some good advice—and if you'll follow it I'll let you have the hundred too. Take up a course with the International Correspondence Schools and put in some of your evenings getting special training. The schools will do wonders for you, I know. We've got several I. C. S. men right here in the bank.'"

"That very night Billy wrote to Scranton, and a few days later he had started studying at home. Why, in a few months he had doubled his salary! Next thing I knew he was put in charge of his department and two months ago they made him Sales Manager. It just shows what a man can do in a little spare time."

Employers are begging for men with ambition—men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of man! The International Correspondence Schools are ready and anxious to help you prepare for something better if you will only make the start. Do it now! At least find out what the I. C. S. can do for you.

Mail the coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7691-D, Scranton, Penna.

Oldest and largest correspondence schools in the world
Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> French | |

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Radio | |

Name..... 6-26-25
Street.....
Address.....

City..... State.....

Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

BUY DIRECT SAVE HALF

GRADE A QUALITY GOODS at WHOLESALE

Any handy man can install his own plumbing and heating by our new, easy method. Free installing plans show you how. You save waste and high labor cost with our cut-to-fit system. Fifty years of economy service to home owners, farmers, builders and mechanics. Million dollar plants behind our guarantee. FREE BOOK shows everything in plumbing and heating fixtures and supplies. Write today for copy.

HARDIN-LAVIN COMPANY
106-16 West Pershing Road, Chicago, Ill.

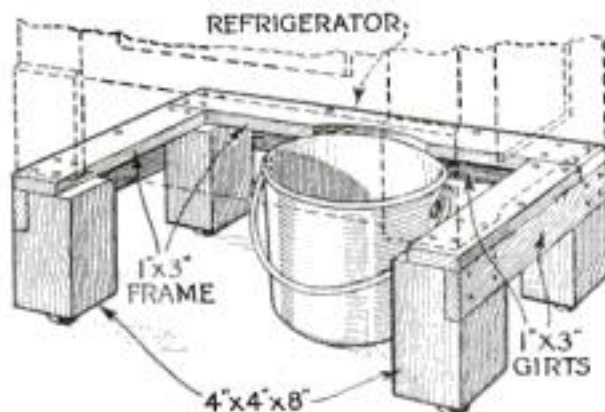
The Shipshape Home

(Continued from page 99)

Improving Your Ice Box

ICE BOXES and refrigerators usually have such short legs that only a shallow pan can be placed underneath to catch the drip. In hot weather the pan may require to be emptied several times a day.

To provide space for a deeper drip pan or a good sized bucket and also to reduce the amount of stooping the housekeeper has to do in using the refrigerator, we



Stand for ice box designed to allow a large pan or bucket to be placed under the drip pipe

have made it a practice for many years to build a solid frame or pedestal from 8 to 10 in. high upon which to set our ice box.

The legs of the frame are 4 by 4 in. yellow pine; the platform and girts of 3/4-in. pine strips. Casters may be put in the legs to make it easier to move platform and box when the floor or wall has to be cleaned.

It may be thought that raising the ice box higher above the floor would make the ice inside melt faster, but no appreciable effect of this kind has been observed.—HENRY JERVEY.

Replacing Loose Veneer

SOMETIMES when one is repairing furniture, working with veneered wood, or scraping a veneered surface for refinishing, a piece of veneer will be chipped loose from its base. If the piece is replaced in its original position, then steamed a few seconds by placing a fairly damp cloth over it and pressing down with a hot iron, it will be re-glued firmly in place again. After the damp cloth has been removed, set the hot iron directly on the veneer. It will soon be thoroughly dry.

Should there not be enough glue remaining on the veneer to stick, apply a little liquid glue and try again. After the glue is dry, sandpaper the surface smooth.—R. E. D.

Painting Rough Work

I ALWAYS keep my paintbrushes in cans partly filled with raw oil, as suggested in an old issue of POPULAR SCIENCE MONTHLY, and from time to time have to change the oil as it becomes thickened with paint. Instead of throwing it away I pour the oil and any odds and ends of paint I have left, in one large can and use

(Continued on page 101)

AMPLION

Product of nearly 40 years' Experience



Hear this creation of the originators and oldest makers of loud speaking devices, Alfred Graham & Co., England. Clear, life-like tone, supreme sensitivity and broad musical range explain its world-wide leadership in popularity. Six models, including phonograph units, with cords and panel plugs, at \$12 up. Write for "Amplion Pedigree."

THE AMPLION CORPORATION OF AMERICA

Suite M, 290 Madison Avenue, New York
Chicago Branch: 27-29 North Morgan St.
Burndept of Canada, Ltd., Toronto

Moore's Invites Pen Counter Comparisons
The write Test

Buy a pen where you can try a pen—at the pen counter. Where writing qualities are apparent.

Moore pens are not on sale at every store—at better stores everywhere.

THE MOORE PEN CO. BOSTON • MASS.

Prices Reduced On All Standard Make TYPEWRITERS

Lowest prices in Years

We will ship any make you choose for one week's trial. Underwood, Royal, L. C. Smith, Remington, Woodstock, etc.

Easy Terms

Pay less than rent each month and own typewriter. Guaranteed as good as new.

Perfectly re-manufactured by experts—the famous

"Young Process." Send for our

free trial offer and low prices now. WRITE TODAY.

AGENTS WANTED EVERYWHERE. SPECIAL OFFER NOW.

YOUNG TYPEWRITER CO.

654 W. Randolph St., Dept. 1425, Chicago



Direct from Factory

\$39.00 buys this RACEABOUT torpedo body in gray prime for your Ford. Special hood and bullet nose shell.

Write for Catalogue
AMERICAN TOP & BODY CO.
Lake St. Delphi, Ind.

The Shipshape Home

(Continued from page 100)

the resulting paint to weatherproof inconspicuous woodwork around my lot, chiefly my homemade wooden sidewalks. It is excellent for coating joints in outside woodwork and, when thinned with turpentine, as a ground or priming coat for rough woodwork.—ERIC B. ROBERTS.

A Quickly Made Stepladder

ALTHOUGH there is a stepladder in almost every house, frequently a second ladder would save a good deal of work if one were to be had. This is particularly true when ceiling work or paper hanging is to be done and it is desired to use two stepladders to support a long plank. In such cases, or when no stepladder at all is available, it is a simple matter to make one from scraps of wood as shown in the accompanying illustration.

The two side pieces are nailed together temporarily and cut out as if they were one piece. Then they are separated and the steps, supports and braces are nailed or screwed securely in their place as shown.—R. M. S.



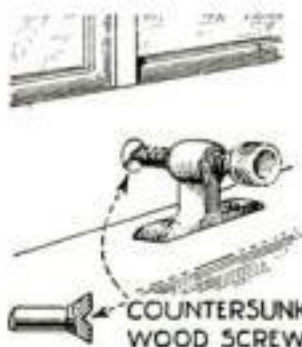
For light repair work

Holder for Garbage Can

AN OLD auto tire serves very well as a means of preventing stray dogs, or, for that matter, mischievous boys, from tipping over the garbage can. Nail the tire in a horizontal position against the fence, post or wall near which the can stands, placing it at a distance from the ground equal to about half the height of the can. Lift up the garbage container and set it bodily within this useful holder.—C. L. MELLER.

Stops Windows from Rattling

A COMBINED anti-rattling device and window lock may be made from a common auto door and window anti-rattler, which usually can be obtained for ten cents. Saw off the rubber disk and grind the end of the screw to a point. Fasten in place on the sill or against side of window and screw the point into the sash far enough to make a mark. Then countersink the head of a flat-head wood screw and screw it in place to serve as a socket for receiving the pointed end of the anti-rattler.—F. J. WILHELM.



An anti-rattler in use



"B.V.D."
Union Suit
(Patented Features)
Men's \$1.50
the suit
Youths, 85c

"B.V.D."
Shirts and
Drawers 85c
the garment

FOR the matchless
comfort, fit and
wear, that have given
"B.V.D." a generation
of world-leading pop-
ularity—

Be sure to SEE it's "B.V.D."

From its special-
ly treated nain-
sook, woven in
our own mills,
to the last detail
of its scientific
construction
"B. V. D." is an
underwear with
differences that
count. They give
"B.V. D." a qual-
ity as unique as
the fame of its
trade-mark.

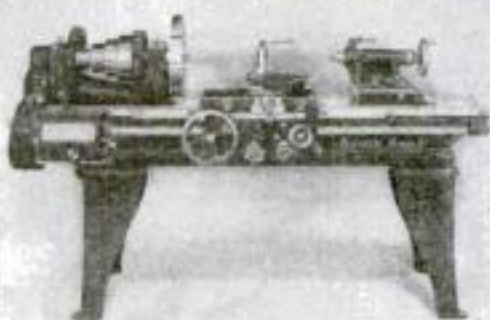
It always bears
this
red-woven label→



The B.V.D. Co., Inc., N.Y.

Sole Makers
"B. V. D." Underwear

© 1926 The B. V. D. Co., Inc.



16 inch x 8 foot Quick Change Gear
Screw Cutting Lathe

New Lathe © Catalog Free!

Shows 96 styles and sizes from
the smallest Bench Lathe to
the largest Factory Production
Lathe. Describes—

The New South Bend Lathe
a heavier, stronger Lathe of greater belt power—equal in accuracy and precision to any other Lathe made. The New South Bend Lathe sells at attractive prices—each one a remarkable value. Write for Free Catalog.
Easy Payments if Desired
South Bend Lathe Works
822 East Madison St., South Bend, Ind.

Shave Electrically

You can't imagine how smooth and pleasant your morning shave can be until you try the new Vibro-Shave Electric Safety Razor. Its electrically operated blade, vibrating 7200 times a minute, is the secret of this new, scientific method of perfect shaving.

Send us \$10.00 today, and we will send you the complete outfit, including face and scalp massage attachments, five blades, cord and plug, attractively boxed. Your money refunded without question within five days if you are not satisfied.

Vibro-Shave blades last three times as long as ordinary blades
For Use With 110 Volts Alternating Current Only
RAZOR PRODUCTS CORP.
1440 Broadway Dept. A
New York

Write for
illustrated
circular





FRANK SIEGRIST, brilliant young trumpet soloist, three seasons with White-man, uses a Conn.

You, too, can win success in music

SIEGRIST earns a princely salary for his brilliant solos. His mastery of the highest register amazes his hearers. He uses a Conn trumpet because, he says: "the intonation, valve action, and immediate response give added confidence in my playing."

There's profit and pleasure in music. You can fit yourself for it quickly. Start now to cultivate your musical bump with a Conn trumpet, saxophone, trombone, any band or orchestra instrument. Brief, pleasant practice enables you to win pleasure and profit. Send now for free book and details of Free Trial, Easy Payments on Any Conn Instrument.

CONN

BAND INSTRUMENTS
WORLD'S LARGEST MANUFACTURING

C. G. CONN, LTD., 632 Conn Building, Elkhart, Ind. Please send, free, "Success in Music" and details of trial offer on

(Instrument)

Name.....
St. or R. F. D.....
City, State.....
County.....



Powel Crosley, Jr., has developed in the **CRESCENDON** a device that gives this **4 TUBE RADIO** performance **\$29** expected in sets of much greater cost

4-29



CROSLEY RADIO

Write Dept. 17 for booklet

THE CROSLEY RADIO CORP.
Cincinnati, Ohio

West of the Rockies add 10 per cent to all prices

Dealers sell Crosley Radios from \$9.75 to \$75, and the Musicone Loudspeaker at \$14.75

Better Shop Methods

Old Bill Says—

LONG attention to small details, hard study, patient waiting, and usually a good many reverses and disappointments are a part of the game of learning to be a good mechanic.

Half of the job is setting it up.

Use lard oil when available for taps and dies; it saves the tools and does better work.

When bolting down a job on the planer and screw jacks are used, always place a hard block of wood, cardboard or paper under them, so they hold better.

The best mechanics need the least supervision.

Mistakes need not be looked for if you keep the words *vigilance* and *caution* ever before your mind.

Every mechanic should have a fairly good knowledge of shop mathematics if he hopes to make progress.

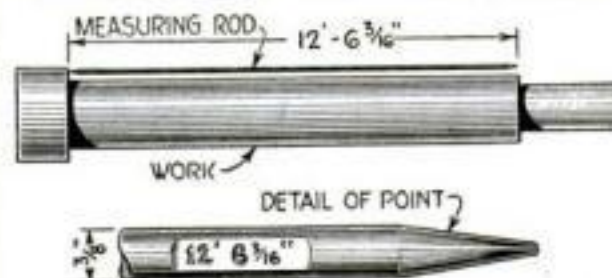
When using a square-nose planing tool for finishing cast-iron, be sure to chamfer the rear edge so that the tool will not dig in; and chamfer the front edge so that it will not break off and leave a rough surface on the work.

The machinist who has traveled about a little and worked in several shops is usually more resourceful than one who has not.

Why does one grind a twist drill frequently, yet seldom ever think of grinding a tap?

How to Make Accurate Shoulder Measurements on Large Work

TAKING measurements of distances beyond the capacity of ordinary measuring tools is a part of the day's work for the man operating a big lathe



A steel rod is a convenient and reliable means of checking the measurements on heavy work

or planer. There are several ways in which this is accomplished, that is, with the use of steel tapes, measuring sticks, two-foot rules, or steel rods. The method

depends on degree of refinement required.

If the work is to be duplicated or repeated in the future, a steel measuring rod is by far the most convenient and reliable means of checking the measurement, and it forms a permanent record. It is especially necessary on those classes of work that require the distances to be held within fairly close limits, say 1/64 in. in a length of from 15 to 20 ft.

To make a measuring rod, select a piece of cold rolled steel from 1/4 to 3/8 in. in diameter, cut it 1/4 in. longer than the length to be measured, and point one end as shown. The next step is to lay off the distance on some flat surface such as a large surface plate, a planer table, or a lathe bed.

Clamp a parallel block squarely in place for a starting point and measure from this with a scale, scribing a line at each step until the final distance is marked off. Then clamp a second parallel at this point. The two parallels will serve as a gage for checking the rod.

Try the rod, note the surplus length, and turn it back until the rod will go between the blocks. If the rod should be only slightly long, it may be filed on the ends until it goes. If, on the other hand, it is slightly short, it can be stretched by peening the middle.

File a flat spot near one end, stamp the size, and the rod will be ready for use. It is manipulated in the same manner as calipers or an inside micrometer.—L. H.

How to Prevent Blueprints from Curling in a Drawer

BLUPRINTS and tracings that are kept flat in filing-cabinet drawers have a tendency to wrinkle and curl up at the edges. When a drawer is being closed, the sheets often catch and are torn or wrinkled. This is especially apt to occur when the drawer is well filled with the prints, and is annoying to anyone who prides himself on his neat work.

A simple way to prevent the prints from catching is to drive three 2-in. finishing nails through the back of the drawer about 1/2 in. from the top. When the back edges of the sheets are slipped under these nails, there is no danger of their becoming curled.



The sheets are held under nails at the back

THE PRACTICE of resharpening files is seldom if ever economical. Some of the larger may be recut by factories making a specialty of such work, but resharpened or recut files do not give as satisfactory service as new files. It is doubtful if any economy is effected by their use owing to their shorter life. As a rule the saving is not sufficient to offset the difference in the cost of a new file.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several small articles. Price 25c. Larger sizes 50c and \$1.00 postpaid. Johnson Smith & Co., Dept. 522, Racine, Wis.

Microphone Transmitter Button



\$1.00 POSTPAID

You can easily make a highly sensitive microphone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the state. It is ultra-sensitive and is the greatest invention in microphones. You can mount the button almost anywhere—card boxes, stove pipes, still radiators, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone conversations; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. \$3.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE \$1.00 POSTPAID ANYWHERE.**

JOHNSON SMITH & CO., Dept. 522, Racine, Wis.

U.S. BABY TANK

25 Cents



It goes with real Yankee Pop—by its own power. Most remarkable Toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down, it will crawl along, overcoming all obstacles, in the same life-like manner as the larger tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys. yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts; it will go backward or forward at will. 2 1/2 inches long. Price only 25 cents prepaid.

NEW BOOK ON ROPE SPLICING

A most practical handbook giving complete and simple directions for making all the most useful knots, hitches, ringed splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots Illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c prepaid.

MIDNET BIBLE

GREAT CURIOSITY

Smallest Bible in the world. Size of a postage stamp. 200 Pages. Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE 15c each, 3 for 40c, 12 for \$1.35, 100 for \$7.50. Also obtainable in Leather Binding, with gold edges. Price 50c each, 3 for \$1.25, \$4.50 per doz. Magnifying Glass for use with Midnet Bible. 15c.

Every Boy His Own Toy Maker

Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Boat, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages, 150 illustrations. PRICE, 10c postpaid; 3 for 25c.

MAGICIAN'S OUTFIT

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment. **ANYONE CAN DO THEM** **75c**

It is great fun mystifying your friends. Get this Cabinet of Tricks, and you will be the greatest in your district. It contains the apparatus for seven different tricks, including The Disappearing Box, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick in Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket; the Magic Nail with which you can apparently get your finger stuck in two; the Wonderful Card Trick in card is placed in an envelope, and when open an entirely different card is found; The Disappearing Coin Box a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination; The Famous Disappearing Penny Trick; The Glass Cabinet and Vanishing Coin Trick a coin is dropped into a glass of water, and when the water is poured out the coin has vanished. With the tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence, with this Cabinet of Tricks in his possession, can give a better entertainment not inferior to some regular magicians. Besides the tricks contained in the Cabinet, there are many other facts and illusions fully explained with full printed instructions, for which you easily make or procure the necessary apparatus. This unexcelled Cabinet of Tricks for **ONLY 75 CENTS POSTPAID TO ANY ADDRESS.**

A Deluxe Edition of our new 1925 CATALOG mailed on receipt of 25c. Handsome cloth binding. Only book of its kind. 420 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, interesting books, curiosities in seeds and plants, etc., unsurpassable elsewhere.

STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. Prices, postpaid: 40 Bills 20c, 125 for 50c, or \$3.50 thousand postpaid.

Wonderful X-Ray Tube

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price 10c, 3 for 25c, 1 doz. 75c. Johnson Smith & Co.



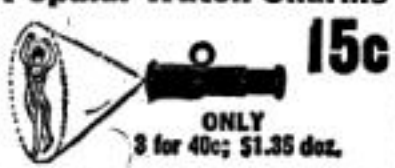
Good Luck Ring
Quaint and Novel Design
A VERY striking and uncommon ring. Silver finish, skull and crossbones design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, Good Luck Ring. Very unique ring that you will take a pride in wearing. **ONLY 25 CENTS.**

Exploding Cigarettes



JUST LIKE ORDINARY CIGARETTES, BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud BANG! A great tooth provoker yet entirely harmless. Price 25c per box.

Popular Watch Charms



ONLY 15c
3 for 40c; \$1.35 doz.

Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

CIGARETTE MAKER



Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs 1/2 oz. Made entirely of metal, nickel-plated. Price 25c postpaid.

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

The Magic Flute, or Human-atone, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produce very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument the effect is as charming as it is surprising.

Novelty Badges



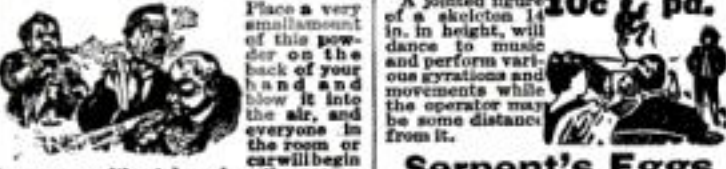
Rising Perch 10c. Garter Inspector 10c. Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. 10c, each badge, 3 for 25c, or 75c per doz. p.p.d.

BLANK CARTRIDGE PISTOL



This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard .22 Calibre Blank Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. A Great Protection Against Burglars, Tramps and Dogs. You can have it lying about without the danger attached to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. **PRICE ONLY \$1.00 Postpaid.** Blank Cartridges 22-cal., shipped by express only, 50c per 100. Johnson Smith & Co., Dept. 522, Racine, Wis.

Sneezing Powder



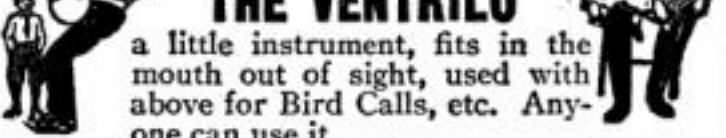
Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For parties, political meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 10c or 3 for 25c.

Mystic Skeleton



A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs



Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c p.p.d.

BOYS! BOYS! BOYS!

THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

THE VENTRILO

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it.

Never Fails. A 32-page book on ventriloquism, and the Ventrilo, ALL FOR 10c postpaid.

ITCHING POWDER

This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more.

Great Fire Eater

Most Sensational Trick of the Day!

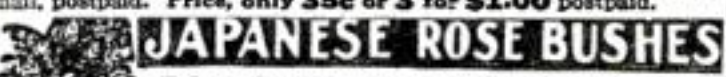
With the Fire Eater in his possession any person can become a perfect salamander, apparently breathing fire and ejecting thousands of brilliant sparks from his mouth, to the horror and consternation of all beholders. Harmless fun for all times, seasons and places. If you wish to produce a decided sensation in your neighborhood don't fail to procure one. We send the Fire Eater with all the materials, in a handsome box, the cover of which is highly ornamented with illustrations in various colors. Price of all complete only 30 cents, postpaid.

SQUIRT ROSE



A REAL STARTLER. This is the most popular of all squirt tricks. The flower in your coat looks so fresh and sweet that everyone is tempted to inhale the delightful perfume. Then is the moment to press the bulb. Geesh! It's not they jump! There is a very long rubber tube that readily reaches to the pocket of your coat or trousers, and the bulb is large enough to make a dozen shots with one loading. PRICE 25c each, or 3 for 65c postpaid.

LOOK 35c Look



Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

JAPANESE ROSE BUSHES

The Wonder of the World. Japanese Rose Bushes bloom all the year round. Just think of it. Six weeks after planting the seed, the plants will be in full bloom. It may not seem possible, but we positively guarantee it to be so. They will bloom every ten weeks, Summer or Winter, and when three years old the bush will be a mass of roses, bearing from five hundred to a thousand roses on each bush. The flowers are in three shades—white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. Price, 10c packet, 3 pkts. for 25c postpaid.

Postage Stamps Accepted

ADDRESS ORDERS FOR ALL GOODS ON THIS PAGE TO

JOHNSON SMITH & CO. DEPT. 522, RACINE, WIS.

How Much Life Do They Show?

There's one sure sign of life at a machine. That is its record of output on a Veeder Counter.

There's one sure sign that designer and operator are alive to their opportunities. That's a mounting production-record on the Counter.

The push behind development work; the drive behind the operator's work—these show in the "Veeder" record. Plenty of signs of life on the job, when it has to register on a

Veeder COUNTER

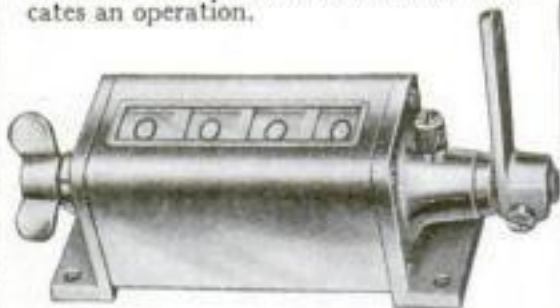
The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable;



its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines and most adaptable to experimental work. If run backward the counter subtracts.

Price \$2.00. (Cut 4/5 size.) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also \$2.00.

The Revolution Set-Back Counter below records the output of the larger machines where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once around. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels as illustrated, \$10.00—subject to discount. Cut less than one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, \$11.50 (list).

The Veeder booklet shows instruments that "count everything on earth." See them, by sending for the booklet.

The Veeder Mfg. Co.
44 Sargeant St. Hartford, Conn.

Better Shop Methods

Mounting a Heavy Chuck on a Turret Lathe

By ALBERT A. DOWD

"HEY, Tom!" yelled Frank to another workman just across the aisle. "Come over here and help me put this chuck on, will you?"

"Sure," said Tom. "I'll be right there."

He found Frank struggling with a heavy 15-in. chuck on the floor beside a turret lathe. The chuck and adapter weighed at least 250 pounds. The two men set it on the ways of the machine, but lifted, tugged and tried in vain to get it started on the threaded end of the spindle. If you



The chuck is lifted and clamped firmly on a boring bar which is mounted in the turret; then it is threaded on the lathe spindle.

have ever tried it, you know how difficult a job it is.

As they were hard at work on it, along came one of the "old-timers." He watched for a few moments and then said: "Wait a minute, boys, and I'll show you an easier way to do that."

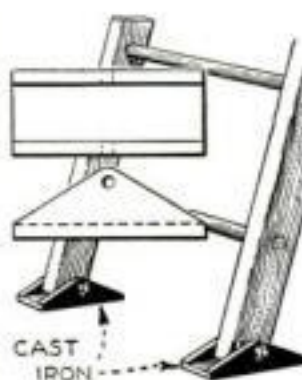
He picked up a 3-in. boring bar lying on a nearby bench, put it in one of the turret holes, and clamped it there.

"Now, fellows," he drawled, "just lift the chuck up and slide it onto the bar and tighten the jaws on the bar. Then all you've got to do is move the turret up toward the spindle and pull the belt around by hand until you catch the thread in the adapter and get it well started. After that just twist it on the rest of the way and the job is done."

And the Old-Timer grinned and passed on down the aisle.

Ladder Shoes Prevent Mishaps

SLIPPING ladders cause so many industrial accidents that every precaution should be taken in connection with their use. The simple safety device illustrated is well worth the cost of installation. It consists of a pair of cast-iron shoes, one for each leg of the ladder. The only machining is drilling a hole for bolt or pin. Shoes are especially useful on wet or oily floors.—H. L. W.



A canoe of outstanding beauty

You'll admire the "Old Town Canoe" the first time you see it. The trim, graceful lines and the jaunty way it rests upon the water will win you at a glance.

But, you must actually paddle an "Old Town" to fully appreciate the advantages of this canoe. "Old Town Canoes" are light in weight and remarkably easy to handle. They respond instantly to every dip of the blade. They are steady canoes too—perfectly balanced.

"Old Town Canoes" are patterned after actual Indian models. Of course, we have improved and strengthened the red man's craft, but the original lines have been retained.

"Old Town Canoes" are low in price too. \$64 up. From dealer or factory.

The 1926 catalog is beautifully illustrated, with all models in full colors. It gives prices and complete information. Send for your free copy today. OLD TOWN CANOE COMPANY, 1695 Middle Street, Old Town, Maine.

"Old Town Canoes"

FOR CLEAR, QUIET "B" POWER



RADIO Storage "B" Battery

12 Cells 24 Volts Lasts Indefinitely—Pays for Itself

Economy and performance unheard of before. Recharged at a negligible cost. Delivers unfailing power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy class jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries is received. Extra offer: 4 batteries in series (96 volts), \$10.00. Pay cash or on account after examining batteries. 5 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80 Chicago, Ill.
Makers of the Famous World Radio "B" Storage Battery
Prices: 6-volt, 100 Amp. \$11.35; 120 Amp. \$13.35; 140 Amp. \$14.00.
All equipped with Solid Rubber Case.

World STORAGE BATTERIES
Set your Radio Dials at 220 meters for the new 1000 watt World Storage Battery Station, WSHC, Chicago. Watch for announcements.
KDKA-WFAP-WGN-WJS-KHJ-KGO-KFAF-WJY-KOP



Try Any Instrument In Your Own Home

You may now have any musical instrument for a week's free trial in your own home. Examine it, show it to your friends, play it as much as you wish. No obligation to buy—no expense for the trial.

Easy Payments
If you decide to buy, payments are arranged in convenient small monthly sums. A few cents a day will pay for your instrument. Special offers on complete outfits.

The exceptional tone quality of Wurlitzer instruments is the result of 200 years' experience in musical instrument building. Used by leading professional musicians, prominent bands and orchestras. Usually easy to play.

SEND FOR New Catalog

Describes and illustrates every known musical instrument—many shown in full colors. Special factory prices direct to you. All details of free trial, easy payment plan. All sent free—no obligation. Write today!

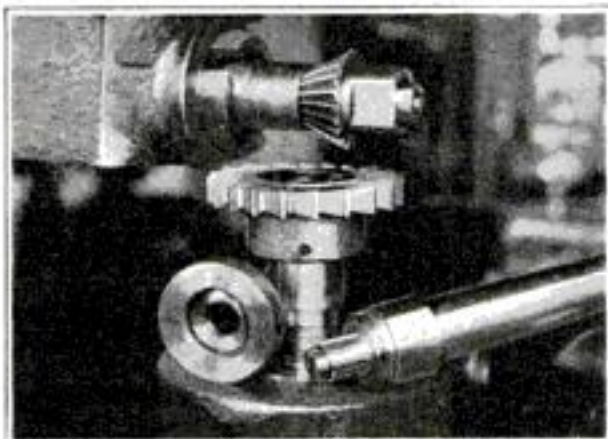
Rudolph Wurlitzer Co., Dept. 1785
120 W. 42nd St., New York 117 E. 4th St., Cincinnati
329 S. Wabash Ave., Chicago—134 Golden Gate Ave., San Francisco
Copyright 1924, Rudolph Wurlitzer Co.

Better Shop Methods

Expanding Arbor Holds Side Cutting Mills for Fluting

By O. S. MARSHALL

TO PERMIT a clean sweep across the face of blank side cutting mills while fluting them on the sides, the expanding mandrel shown in the drawing below was designed. Its operation is



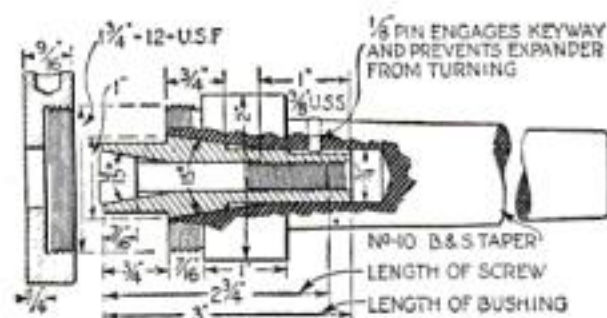
How the blank side cutting mill is held on the expanding arbor for the fluting process

made clear in the photographic illustration above.

The taper shank of the arbor is made to fit the dividing-head spindle, in this case a Brown and Sharpe No. 10 taper. There are four parts to the complete arbor; the main arbor, an inner split bushing, an expanding screw for the latter, and the retaining nut, which holds the expanding bushing within the main arbor.

The expanding bushing has a taper at its forward end, which is to fill the mating taper within the main arbor, thus centering the blank when the closing-in nut has forced the bushing in contact with the main arbor. The blank is finally tapped against the closing-in nut, against which it rests while being fluted.

The blank preferably is fluted on its periphery first, and, in case of large-sized



Details of the expanding mandrel, which can be made in several sizes as the work requires

blanks, a steadying pin may be used, located in the face of the retaining nut at a convenient position to enter one of the spaces. This insures against any possible slipping of the blank.

Only two or three sizes of such mandrels need be made, since split rings may be set on the nose of the taper bushing to accommodate holes of varying sizes.

Putty Useful in Babbitting

PUTTY is superior to clay for closing the ends of bearings that are to be babbitted. With clay there is always some risk arising from the moisture, which may cause an explosion and sometimes serious injury. This danger is eliminated by the use of putty.

Light and Power for Twenty Years



No DOUBT you remember the first automobile you ever saw. Perhaps you'll remember, too, that it bore a shiny little tank marked "Prest-O-Lite" . . . for Prest-O-Lite gave the motor-car its first dependable eyes.

This same company, which has served the automotive industry so successfully for more than twenty years, today serves radio with a dependable, long-lived battery, of special design, that brings out the best in any set.

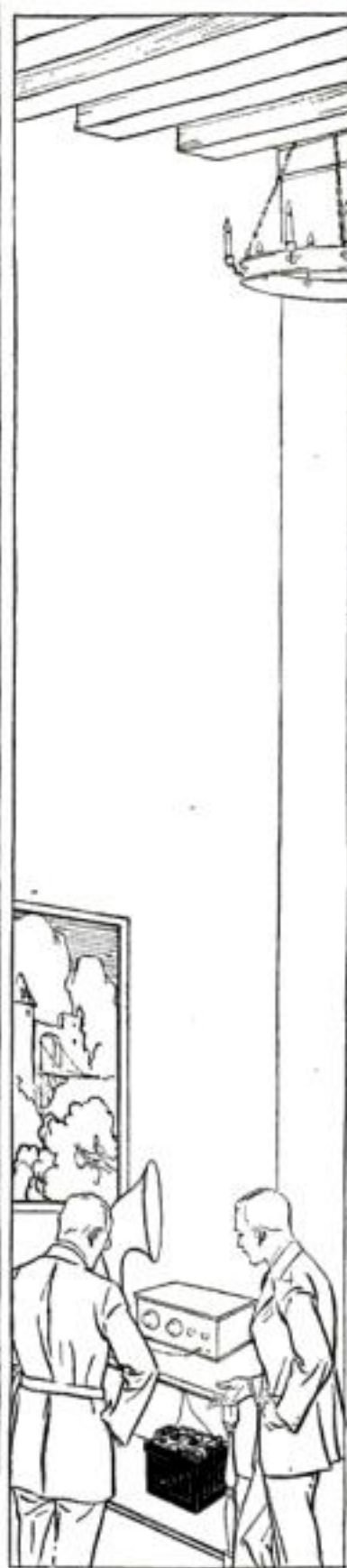
You can rest assured that Prest-O-Lite Batteries are correctly rated and deliver full power at all times.

They are attractively priced from \$4.75 up.

THE PREST-O-LITE CO., Inc.
INDIANAPOLIS, IND.
New York San Francisco
In Canada: Prest-O-Lite Company
of Canada, Ltd., Toronto, Ontario

Send for this
free booklet

"What every owner of a radio should know about storage batteries."



Designed especially for radio

Prest-O-Lite

STORAGE BATTERIES FOR
MOTOR-CARS AND RADIO



"LIGHTING FIXTURES"
Ready to hang.
Direct from the manufacturer.
Completely wired, including glassware.
Send for New Catalogue No. 27
(Just reduced prices)
Special proposition to Dealers
ERIE FIXTURE SUPPLY CO.
Desk A, Erie, Pa.

Own a CORONA

The portable typewriter built like an office machine. Has four-row keyboard and big-machine features throughout. Write to
Corona Typewriter Co., Inc.,
112 Main Street, Groton, New York



Bodies of Rare Beauty for Fords at Factory Prices

This Model in
Grey Prime.

\$39.50



Write for circular
A-10 showing this
De Luxe Model and
others.

\$22.75 and
up



Sport Body Works, Aurora, Illinois

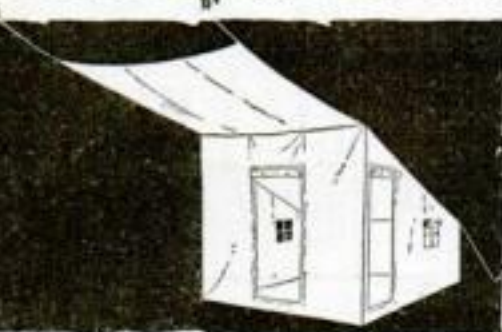
For Economy AMATCO TENTS



AMATCO HOME-CAMP. No center pole. Maximum head room. Four steel corner poles collapsible to 2½ feet. Always rigid, erect, convenient and roomy. OLIVE SHOWER-PROOF fabric.



AMATCO BACTISH. A modernized wall tent. Ideal for the tourist camper. Generous base size. Big cot room. The sensible tent at a sensible price.



AMATCO BOSTON AUTO TOURING TENT. The De Luxe Auto Touring Tent. Convenient. Comfortable. Two roll-up doors. Two bobbinet windows for ventilation. For further details on these and other tents write for combination catalog-instruction book, HINTS FOR TOURISTS AND CAMPERS.

AMATCO TENTS represent true economy. Their sturdy construction and quality materials insure long life. At your dealer's or sent direct to you, carrying charges prepaid.

AMERICAN TENT & AWNING CO.
Manufacturers
100 Cummingtown St., Boston, Mass.



LET US SEND THIS VALUABLE BOOKLET "Hints for Tourists and Campers" by The Old Timer

combined with complete information on AMATCO TENTS and accessories. Every prospective auto tourist or camper should have this little booklet. Sent Absolutely Free. MAIL THIS COUPON TODAY.

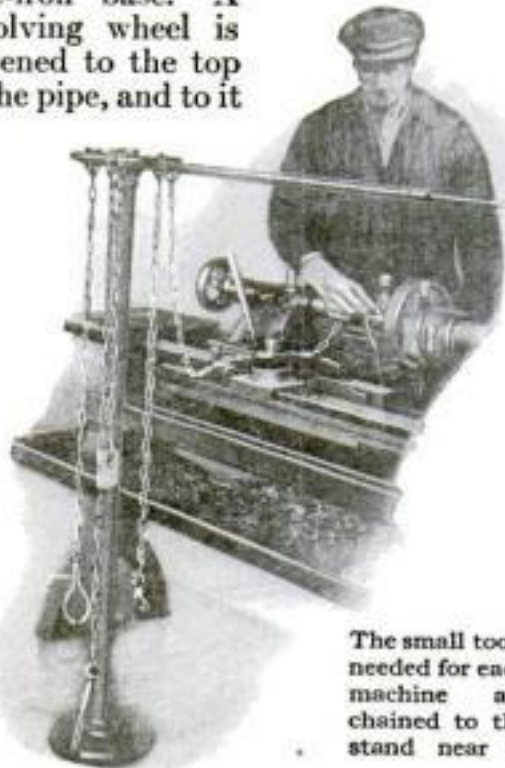
Please send me above booklet by return mail.

Better Shop Methods

Revolving Stand Keeps Tools Together in School Shop

FOR keeping tools with the machine to which they belong, the fixture illustrated below has proved useful and economical in the machine shop of the Kern County (Calif.) Union High School. One of these fixtures was built for each of the lathes and other machines in the shop.

It consists of a gaspipe screwed into a cast-iron base. A revolving wheel is fastened to the top of the pipe, and to it



The small tools needed for each machine are chained to the stand near it

are attached steel chains, which carry the various small tools needed for each machine. The chains are welded to the tools so that they cannot become separated.

These fixtures, all of which were made in the high school foundry and machine shop, have more than paid for themselves by saving time and eliminating the loss of tools.—G. W. GARRARD.

Electrical Way of Measuring the Velocity of Water

A SIMPLE and yet very exact method of measuring the velocity of the flow of water in pipes makes use of a well-known electrical principle. At the point where the water from the reservoir flows into the pipe, which may have a diameter of from 12 to 16 in., a bag containing about 1 lb. of salt is introduced. The rushing water destroys the bag quickly as it is carried along, and the salt dissolves.

At a distance of 500 or 1000 feet from the intake, two electrodes, one of copper, the other of zinc, have been introduced previously into the pipe; they are insulated from the pipe, but in contact with the flowing water. The electrodes form a galvanic element with a tension of 0.2 volt, as shown by a voltmeter. When the water holding the salt in solution reaches the electrodes, the indicator of the voltmeter immediately registers a tension of 0.5 volt.

The difference in time between the moment when the salt was introduced in the pipe and the moment when the hand of the voltmeter jumped to 0.5, represents the time taken by the flow of water for the measured or test distance.—ERNEST WELLECK.



New! LA TWIN MOTOR FOR ROWBOATS

The sensation of the year. Offering new advanced features in Power, Speed, Control, Weight and Performance. For example—

NEW—Super-Power Twin Motor—At normal speed develops 3.85 H. P. (Brake Test). In racing trim develops 4.65 H. P.

- NEW—Under-water Stream-Line Design
- NEW—Cuts the water like a knife
- NEW—Giant Drive Propeller
- NEW—Gives flashing speed
- NEW—"Safety Propeller"
- NEW—Protects Boat, Bathers and Motor
- NEW—Super-charged Water Pump
- NEW—Insures a cool motor always at all speeds and reverse
- NEW—Combination Propeller and Rudder
- NEW—Steers WITHOUT A RUDDER!
- NEW—Unit Control Carburetor
- NEW—One easy adjustment for all speeds and weathers
- NEW—"Top-Spin" Easy Starter with big Kilsman Magneto
- NEW—Gets you away in a flash
- NEW—Combination Racing and Trolling Control
- NEW—One throttle lever for all speeds
- NEW—Lifetime Guarantee
- NEW—Against all defects in material and workmanship
- NEW—Five Days' Trial Offer
- NEW—Gives you a chance to match with any other Motor

WRITE FOR FREE CATALOG FOLDER TODAY

LOCKWOOD-ASH
MOTOR COMPANY
617 Jackson St. Jackson, Mich.



ROSS GORMAN
Saxophone Wizard
Earl Carroll Vanover
Okeana

You can play

this easy fingering Buescher Saxophone. Most wonderful music. 3 lessons given on request with each new Buescher True-Tone. Teach yourself. Many play scales right off—easy tunes first week. You can.

Easy to Play, Easy to Pay 325A

Try any Buescher Instrument for 6 days. Satisfaction or no sale. Easy terms arranged. Send postal for catalog and details of trial and payment plans. Mention instrument preferred. No obligation. Send today.

BUESCHER BAND INSTRUMENT CO.
1515 Buescher Block Elkhart, Indiana

Magnified 225 Diameters This is what the tip of a fly's leg is like when seen through the ULTRALENS MICROSCOPE

At last a high powered microscope is within the means of all who wish to study, observe and experiment with the vast world of minute objects invisible to the naked eye. Such fun it is, as well as educational. No technical training required, yet hundreds of scientists and teachers are using this instrument. Gives enormous magnification and perfect definition. Send \$7.50 for complete outfit. Send for descriptive literature.



\$7.50 for Complete Outfit Prepaid

SCIENTIFIC APPARATUS CORP.
Dept. 207 Milton, Pa.

Better Shop Methods

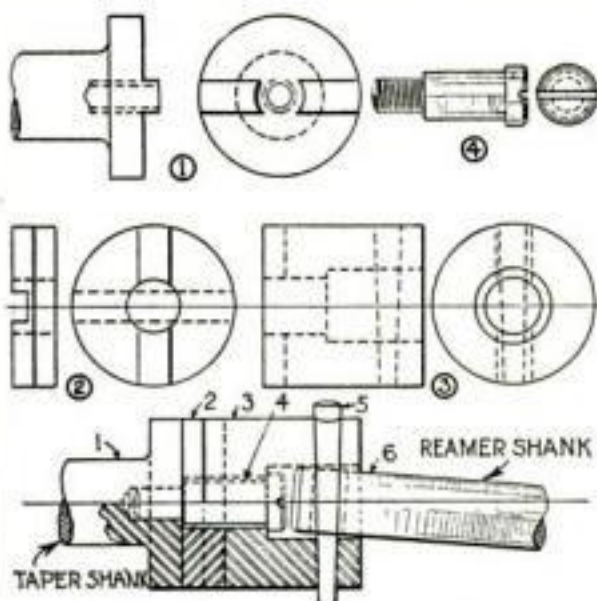
How to Make a Floating Holder for Reamers

By H. L. WHEELER

FLOATING reamer holders of many designs are made for use on turret lathe work. For the most part they are only semi-floating because they are rigid in one direction. Consequently the benefit of the floating effect is not available.

The design illustrated has a full floating joint, which overcomes many of the defects found in the semi-floating type. It prevents the reamer from binding in any direction and insures perfect alinement even in long holes.

The holder is made in three sections of machine steel, carbonized, hardened and ground. The first section (1) is solid,



The parts of the holder and how they are assembled to insure alinement in reaming

with a taper shank to fit the machine, or it may be made with a straight shank to fit a chuck.

A floating plate (2) between the shank and the nose has a central hole about $\frac{1}{8}$ in. larger than the body of the holding screw. It is provided with keys on one side and a recess on the other to fit corresponding seats in the shank and nose (3). There should be about .010 in. side play between projections and slots.

The nose is held in place by a screw (4) passing through a central hole and into a tapped hole in the shank. The screw must be tight against its shoulder, leaving enough room under the head to prevent the whole assembly from binding. There should be about .010 in. clearance on each side of the plate when the screw is up tight.

A taper pin is used to drive the reamer. This passes through a hole drilled in the reamer shank and is tight in the nose of the holder. The hole in the reamer shank should be large enough to give plenty of freedom, but not large enough to weaken the shank unnecessarily at this point.

Making Grinding Wheels Last

THE rate of wear on grinding wheels is increased as the diameter of the wheel is reduced by frequent truing with a diamond. When a wheel is running continuously on production work, very light cuts with a diamond about every twenty minutes will keep the wheel sharp and conserve the working life of the wheel.



Don't neglect your tubes— and good radio can be obtained all summer long!

Give your radio set a spring-boost by invigorating the tubes the Sterling way, and you will find that the quality of your reception is practically as good as you got in winter—always enjoyable for porch dancing, baseball scores, concerts, and musical entertainment to make warm evenings more enjoyable.

KEEP YOUR TUBES FULL OF VIGOR

with the Sterling Tube Reactivator. The meter on this device shows you when tubes need reactivation and proves their increased efficiency after treatment. A high class instrument, easy to operate, and no guesswork in its results.

Price \$12.50 (50-60 cycle)
\$14.00 (25-40 cycle)

For your complete radio home servicing equipment also use Sterling Tube Testers, Sterling Battery Chargers and Sterling Pocket Meters. Ask your dealer!

The Sterling Mfg. Company
Cleveland, Ohio, Dept. V

Sterling
TUBE
REACTIVATOR

THE LINCOLN SPORT PLANE

Build and Fly It Yourself



Blue Prints and Material now ready for Builders! Send 25c for illustrated book. IT TELLS YOU HOW
LINCOLN STANDARD AIRCRAFT CO.
Dept. H, Lincoln, Nebraska
New Flying School Opens June 1st. Earn Your Way Through



Just think! Through our amazing new plan you can get this \$2400 bungalow for only \$1606—a clear cut saving to you of \$803 or actually one third! We furnish you with the finest materials cut to fit direct from our mill—saving you big money on your lumber, mill-work and labor. Satisfaction guaranteed or your money back.

Buy Direct From Mill Save 4 Profits

You positively save four big profits by buying direct from our mill. We give you everything complete—all lumber cut-to-fit, windows, doors, flooring, shingles, lath, glass, paints, varnish, putty, hardware, nails, molding, cupboards—all plainly marked and easily assembled according to drawings and directions we furnish. We pay the freight.

Write now for our beautiful book of homes which shows you a large number of lovely homes. Priced from \$475 up. Send for it at once—no obligation.

INTERNATIONAL MILL & LUMBER CO.,
E-1 South Wenona Ave., Bay City, Michigan

Free CANOE Catalog

KENNEBEC
CANOE
CATALOG
20 pages

FREE Catalog of 17 popular styles including new "Joy-Boy" square-stern sponson outboard motor canoe, boats, equipment. Staunch, dependable. Popular prices. Write!
KENNEBEC BOAT & CANOE CO.
DEPT. G-12, WATERTOWN, MAINE

Keep your muscles limber!



WORK the stiffness out of lame, sore muscles with applications of Absorbine, Jr. The magic bottle quickly takes the ache away from tired muscles—makes them feel new again.

Absorbine, Jr. wakes up the circulation. It combats congestion. Before you know it you are fit again for work or play.

Absorbine, Jr. is equally effective for tired feet—blisters—callouses—cuts and bruises.

At all druggists', \$1.25, or postpaid
Send for free trial bottle

W. F. YOUNG, Inc., Springfield, Mass.

Absorbine Jr.
THE ANTISEPTIC LINIMENT

It's Easy to Build a Powerful Set

Using the New and Improved FRESHMAN "TRF" Low Loss Kit



Straight Line Wave Length Condensers With Low Loss Self Balanced Coils

These are the identical units which have made the FRESHMAN MASTERPIECE factory built Receivers the "World's Greatest Radio Sets."

Complete instructions for building this powerful five tube receiver, written in plain everyday English, together with actual size schematic wiring diagram, are furnished with every FRESHMAN "TRF" Kit.

Sold by Authorized Freshman Dealers Only!

CHAS. FRESHMAN CO., Inc.
Freshman Building, New York
2626 W. Washington Blvd., Chicago



No guessing, less wiring and—no grief—with AMPERITE. Eliminates hand rheostats. AMPERITE is the only perfect filament control. Specified in all popular construction sets. Price \$1.10.

Radiall Company

Dept. P.S.-1 50 Franklin Street, New York City



Better Shop Methods

Old Bill Repairs a Machine

(Continued from page 76)

these circumstances. If we were to weld the break, we would have to dismantle the machine, and it would be a week before you could have it running again."

"We surely don't want that," the president exclaimed.

"And if we were to bolt a patch on," Old Bill continued, "there would always be the possibility that the screws would come loose, and that would mean that the machine would not be accurate. As for strength, most of that iron is to make the machine rigid; about a tenth of it would do for strength alone, so we are amply strong in our repair."

He turned to Bob Laten.

"Just as soon as you have one of the slots chipped out so that you can measure it, phone the length of the key to me, and I will have it planed and sent out at once. Do not chip corners of the slots square but leave them round, as the drill made them."

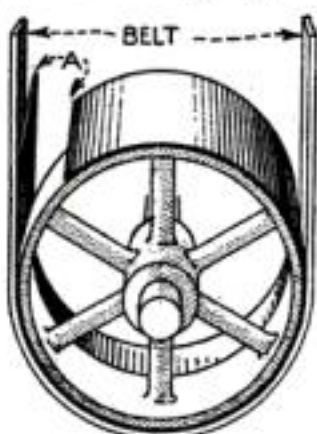
AT THE shop Old Bill made a little computation. He would heat the key about a thousand degrees, and steel would expand six millionths of an inch for each degree; his key was to be six inches long between the heads—that would be an expansion of thirty-six thousandths. Then, he thought, Laten could not get the seats for the head perfectly flat, and the casting would not fit together as tightly as it ought, so he decided he would plane the heads $\frac{1}{16}$ in. closer together than the measurement which Laten presently gave him over the phone.

The red-hot key would have to be driven in place, whereupon the shrinking would pull the parts together; and the key would still be under a considerable load when it was cool, insuring its tightness.

It was just after lunch when the first key went out, and the other four followed promptly, so that not much later than the usual quitting time, the keys had all been shrunk in place, and the mill operatives were reassembling the machine. It was not until the next morning that the president of the firm came out. He had the machine stopped to look at the repair.

"I can't feel the crack, and can barely see it," he said smilingly, pleased with himself at the stroke of fortune that had led him to send for Old Bill.

Curving Light Sheet Metal



Pulley and belt can be used as forming rolls

IN THE absence of forming rolls, a mechanic engaged in experimental work used a unique method for curving sheet metal. A pulley of somewhat smaller diameter than the shell desired was selected, and the sheet (A) fed in between the pulley and the belt while the latter was pulled by hand.—S. W. BROWN.



KESTER METAL MENDER

READY TO USE
The Household Solder

Here's why thousands use Kester Metal Mender. **Simple**—Requires Only Heat! Anyone can use it. **Safe**—No messy pots or dangerous acids. **Sure**—Genuine Solder makes firm metal joints. **Satisfactory**—Works equally well on light or heavy, old or new work. **Economical**—Saves many times its price. **Your Dealer Can Supply You**

Soldering Booklet
"It's a Cinch to Solder"
Upon Request



CHICAGO SOLDER COMPANY
4201-318 Wrightwood Ave., Chicago, U.S.A.

In the best kits

CARTER Radio Parts

are specified by the Manufacturers

Bremer Tully
Hamme-lund Roberts
Silver-Marshall
Samson and others

Your dealer can show you why

In Canada—Carter Radio Co., Limited, Toronto

Carter Radio Co.
300 S. FINE AVENUE
CHICAGO, ILL. U.S.A.

"Experiments With 110-Volt Alternating Current"

HERE at last is a book that gives a practical working knowledge of the alternating current

The only way to gain a thorough understanding of electricity is by direct personal experiment. How a practical knowledge of the alternating current can be gained in an interesting and inexpensive way is shown. The knowledge that comes from experiment is of vastly more value than that acquired from the performance of the stereotyped series of battery experiments usually described in books on Alternating Current.

The book "Experiments with 110-Volt Alternating Current" is needed by every man experimenting with alternating current.

256 pages, 135 illustrations. Price, postpaid, \$1.75

POPULAR SCIENCE MONTHLY
250 Fourth Avenue New York City

SELL CANDY GUM AND MINTS to STORES

BIG PROFITS
FREE GIVEN
I will put you in business as my Direct Factory Agent and Jobber, to take orders for my full line of candies, chocolate bars, mints and chewing gum. Unlimited opportunities for hustlers. No experience needed. I furnish everything. Every store and everybody buys. Work spare time or full time. Write today for catalog, selling plan, Free Samples and Free Ford Offer. Exclusive territory. ACT QUICK.

MILTON GORDON, 1416 Vine St., Cin'tl, O. Dept. 1060

BRAND NEW CATALOG No. 26
Bigger than ever: 40 kinds and sizes of Small Steam, Gas & Gasoline Engines, $\frac{1}{4}$ H.P. up. Small Boilers, Pumps, Toy Engines, Model Air-Plane Motors, $\frac{1}{4}$ H.P. Marine Engines, Model Locomotive Drive Wheels & Blue Prints, Small Lathes, Drill Presses, Gears, Pulleys, Belting & Model Makers' Supplies. Engine Castings & Blue Prints. Sent anywhere 25c Stamps or silver (Preferred) Refunded first order. Modern Engine & Supply Co., Inc. Reorganized: 514 C West Van Buren St., Chicago, Ill., U.S.A.



FREE

140-page Book full of life-size ruled forms, each one completely filled in. The answer to problems of accounting and record keeping for any business or profession.

Send for this **FREE** Book today
John C. Moore Corporation
(Established 1839)
3080 Stone St., Rochester, N. Y.

MOORE'S LOOSE LEAF SYSTEMS
In Use In More Than
300,000 Offices

Big 3-ft. Telescope

Makes people and objects miles away seem close. Brings new pleasures to home, farm, camp, travel, sport. See moon and stars as never before. New Ferry "Wonder" telescope has 5 sections—over 3 ft. long open, 12 in. closed. Fully brass bound. Powerful lenses.

GIVEN!

With Every Telescope! Handsome leatherette covered Carrying Case, light, strong, complete with strap. Handy for farmers, auto tourists and hikers.



Only \$1.85

5 Sections
8-Power Lenses
Thousands Delighted!

"I am delighted with the 'Wonder' telescope. Today I have been watching submarines 3 miles off the coast."—Philip Brush. "I can see across the Mississippi 3 miles and see people fishing."—M. L. Thorn. "I am nearly 80 years old and if I could not get another would not take \$10.00 for it."—A. R. Walker. "I can tell time on the church clock 5 miles away."—Edward Foster. "Could tell color of aeroplane 4 miles away."—Mrs. L. M. Yarbrough. "I saw a Light House 13 miles away."—Clyde Scribner.

Send No Money

Send name and address and Ferry Wonder 3-ft. Telescope with Carrying Case given will come by return mail. Pay postman special bargain price of \$1.85 plus few cents postage. Satisfaction guaranteed or your money back. Supply limited, order today!

Ferry & Co., Dept. 1785, Chicago



ZIP-ZIP

Here is a letter we received from a lady from way out west.

Gentlemen:
My boys were so delighted with the Zip-Zip shooters that they ordered from you that I am enclosing check for one dozen more, I want each of their friends to have one also. Please send these as soon as possible.

Thousands of boys are made happy with this wonderful Zip-Zip shooter. Order from us or your dealer. Send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.



TYPEWRITER PRICES CUT

World's best makes—Underwood, Remington, Oliver—prices slashed to almost half.

\$2 and it's yours

All late models, completely rebuilt and re-finished brand new. **GUARANTEED** for ten years. Send no money—big **FREE** catalog shows actual machines in full colors. Get our direct-to-you easy payment plan and 30-day free trial offer. Limited time, so write today.

International Typewriter Ex., 186 W. Lake St. Dept. 538 Chicago

Better Shop Methods

Pointers on How to Replace Piston Rings Properly

IN FITTING piston rings, several things should be taken into consideration—the trueness of the cylinder, the fit of the piston, and also the condition of the piston ring grooves.

Assuming that the cylinder is fairly true, that the piston fits reasonably well, and that the piston ring grooves are found to be square, then only an allowance for heat expansion need be considered.

Great pains should be used in fitting the rings to the grooves. The ring grooves should be cleaned thoroughly before attempting to fit new rings. The rings should be fitted without oil to the groove; and, before they are placed in the cylinder, oil should be forced behind the rings to make certain that they will not stick when put in service.

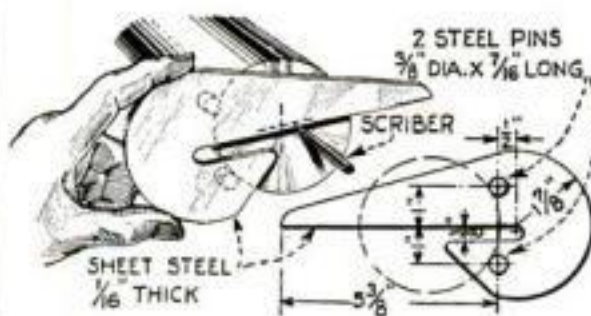
I find in practice that the staggered one-piece concentric ring is quite satisfactory when properly fitted. I also find that the greatest leak usually is behind the ring and not between the wall and the ring face. The top ring, which suffers the greatest heat expansion and wear, should have less clearance at the opening or split than the second and third rings, although this seemingly should be the reverse.

The ring just above the wrist pin should be placed with the split on the side of the piston that tends to receive the angular thrust of the connecting rod during the work stroke. A good way is to place this ring with the splits at an angle of 90 deg. to the wrist pin ends. The splits of the other two rings should be placed 180 deg. apart and about 20 deg. either side of the wrist pin ends. What I have written here applies only to a motor needing rings fitted.—B. A. DUNLAP.

Center Square for Small Work

FOR marking the centers of lathe work and for use in various awkward positions, a center square can be made quite easily as shown. The square is particularly handy for use in marking rings, as it can be applied either inside or outside of them.

A piece of sheet steel and two pins $\frac{3}{8}$ in. in diameter and $\frac{7}{16}$ in. long are needed.

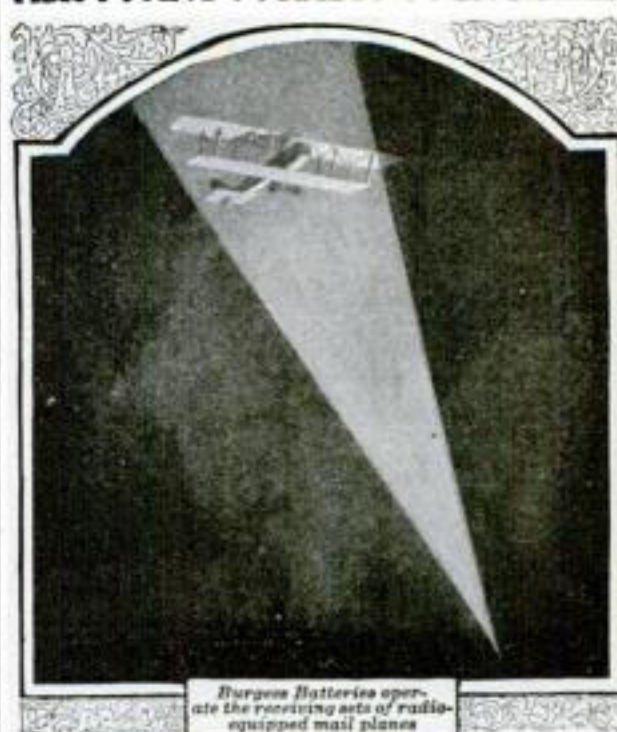


A simple type of square for making centers, bisecting rings, and various awkward jobs

The dimensions of the square may be varied, although those indicated on the drawing have proved satisfactory for ordinary work.

The main precaution required is that the ruling edge of the square should be precisely at right angles to a line connecting the centers of the pins and exactly halfway between them.—L. M. B.

ASK . . ANY . . RADIO . . ENGINEER



An every-night adventure of Burgess Radio Batteries

ONE of the reasons why you should always buy Burgess Radio Batteries is that the batteries used by air-mail pilots—battleships—explorers—and the majority of recognized radio engineers—are evolved in the Burgess Laboratories and manufactured in the Burgess factory.

These batteries are identical with the batteries sold by your dealer and thousands of other good dealers everywhere.

BURGESS BATTERY COMPANY

GENERAL SALES OFFICE: CHICAGO

Canadian Factories and Offices:
Niagara Falls and Winnipeg





How to Play The HOHNER HARMONICA

Play Real Music in 10 Minutes on the HOHNER HARMONICA

SEE how easy it is! Take your instruction book—you can obtain one for the asking—read the simple directions and look at the pictures. Then

take your Harmonica, hold it as shown, place it to the mouth and blow—draw, blow—draw. In ten minutes you will have mastered the scale—and “when you can play the scale you can play all”.

If you want to enjoy the satisfaction and popularity that comes to those who play the harmonica, get a Hohner today—50c up at all dealers—and ask for the Free Instruction Book. If your dealer is out of copies write M. Hohner, Inc., Dept. 182, 114 East 16th St., N. Y.



Buying a Brush? Buy a Good One!

The handle, ferrule, and labor in a cheap brush cost as much as in a good brush. The big difference is in the bristles. The life of a brush is in the quality of its bristles and the way they are fastened.

Buy a good one!

WHITING-ADAMS BRUSHES

Send for Illustrated Literature



JOHN L. WHITING-J. J. ADAMS CO.
BOSTON, U. S. A.

Brush Manufacturers for Over 116 Years
and the Largest in the World

BURN YOUR NAME ON TOOLS WITH THE ARKOGRAF

Protect Your Tools From Theft. Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil. Complete Outfit \$3.50 Prepaid Anywhere. Interesting illustrated circular free. Write today. Agents wanted.

ARKOGRAF PEN CO.
1171-A East Stark St., Portland, Oregon

Better Shop Methods

Duplex Mill Does 15-Minute Turning Job in 3 Minutes

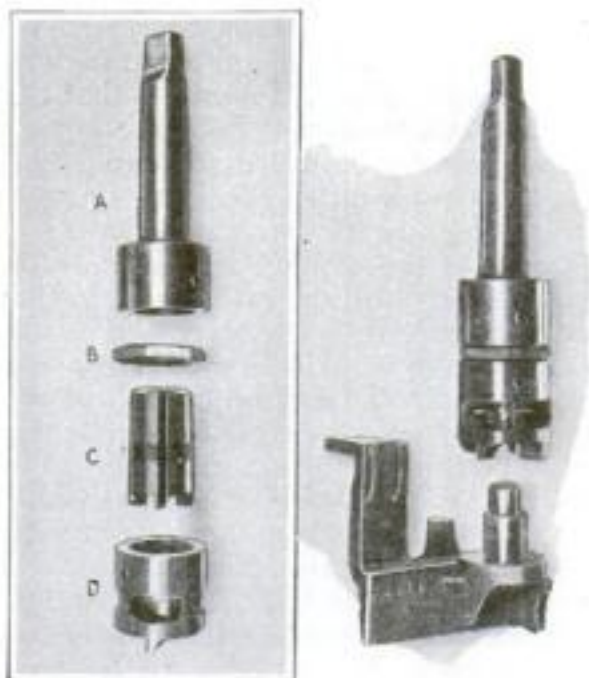
By ALBERT M. THOMAS

IN THE repair shops where I work as a tool maker, we have to machine the pivot pins on hundreds of brackets used on the gates of elevated railway cars. They have to be turned to a $\frac{3}{4}$ -in. diameter at the top and 1 in. at the bottom.

The peculiar shape of these brackets made the job a tedious one in the lathe. The best one could do was four an hour.

Next we tried doing them with a hollow mill in the drill press and though time was saved in the output, we found that it was a hard job to get both sizes to come central with each other.

After a little thought, I developed the duplex mill illustrated. The holder A has



The parts of the duplex mill and how they are assembled for turning awkward brackets

a No. 4 Morse taper shank to fit the drilling machine spindle. The end is bored a perfect fit for the cutter C and has an inserted key corresponding to the upper end of the keyway in C, and also a set-screw to hold it in place.

The nut B is fitted on the threaded part of C and has an adjustment of $\frac{1}{8}$ in. to compensate for grinding.

The cutter D that forms the 1-in. size is counterbored a perfect fit for the lower end of C. It also is provided with an inserted key and a setscrew, while in the body four openings are milled to accommodate the cuttings from C. The cutters are made of good carbon steel, tempered and ground to size.

The brackets are held in the drill press vise. By using this tool, which cuts both sizes at once, a bracket can be done easily in three minutes. Thousands have already been made.

Calculating Drill Speeds

IN FIGURING the cutting speed of a twist drill, the circumference of the drill is measured or calculated on the largest or outside diameter and then is multiplied by the number of revolutions a minute. Twist drills are made in approximately 370 different sizes, ranging from .004 to $3\frac{1}{8}$ in. Drills smaller than $\frac{1}{16}$ in. in diameter are not regularly made of high speed steel.



You will never know how good your radio is until your loudspeaker is a.....

\$14.75

CROSLEY MUSICONE

Write Dept. 17 for Booklet
West of the Rockies, add 10 per cent to all prices
THE CROSLEY RADIO CORP.
Cincinnati, Ohio

Crosley Radios **\$9.75 to \$75.**

Stop Using a Truss



Reduced Fac-Simile Gold Medal.

STUART'S PLAPAO-PADS are different from the truss, being medicine applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered.

Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

Plapao Co., 790 Stuart Bldg., St. Louis, Mo.

Name.....

Address.....

Return mail will bring Free Trial Plapao.....

Looks Like a Real **AUTOMATIC**

Protect yourself from toughs and hold-up men. Most amazing automatic 4½ in. long; good metal finish. Can't tell from real automatic until you pull the trigger and presto! you have Opera Glass, Pocket Mirror, Magnifying Glass, Telescope, Beer Mug, Glass, Mirror, Sun Dial, Compass, etc. Loads of fun useful, instructional. A real protector. Send No Money.

MAKES 10 USEFUL ARTICLES

Just send name. On arrival of "Automatic" deposit with Postman \$1.48 plus a few pennies postage. Satisfaction guaranteed or deposit refunded.

Supply limited. Order now. Big Bargain Catalog sent FREE.

FERRY & CO., Dept. 9775, 3224 N. Halsted St., Chicago, Ill.

TOOL CHESTS
FOR PARTICULAR MEN
Toolmakers and Machinists will find the right Case in our

FREE CATALOG
Send for it TO-DAY.

H. GERSTNER & SONS
529 Columbia St., Dayton, O.

A 2c Stamp

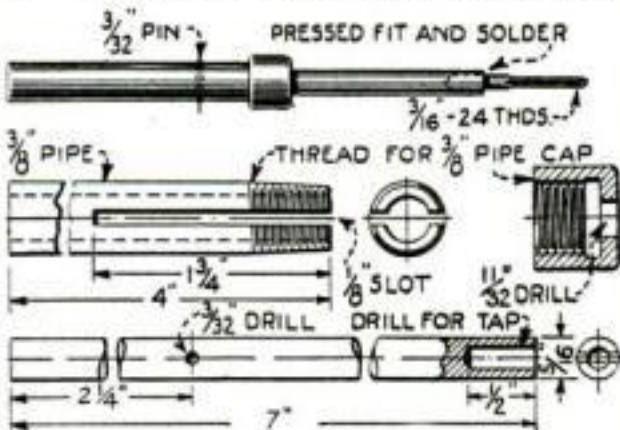
—will start you on the road to success. See Money Making Opportunities on pages 116 to 142.

Better Shop Methods

Adapter for Tapping Small Holes on a Large Drill

A SHOP building large oil engines found that it could do all of the drilling on an engine frame under a large radial drill, with the exception of tapping some small holes for cover plates and the like. For these holes the heavy casting had to be moved to a smaller machine or the holes tapped by hand, until the little device shown was made.

This is a tap holder arranged so that the tap floats vertically. The entry of the small tap into the metal does not mean that the heavy spindle must come with it. As will be seen, the slot and pin pro-



Details of the tap holder, which is designed to allow the tap to float freely up and down

vide a means for revolving the tap, while it is not restricted in its motion up and down.

In use, the revolving tap is brought over the hole and started in by hand pressure on the tap holder. The tap can be run in the required depth and the machine reversed to bring it out with no danger of breaking the tap.

The 3/8-in. pipe is held in the drill chuck and has a cap on the end to retain the parts. The slot must be large enough so that the pin and rod slide freely. The tap can be fixed in the rod by any desired means, although that shown has proved quite satisfactory.—JAMES GARDNER.

Holder for Tempering Pins

SEVERAL dowels, pins, or small punches may be hardened and tempered at the same time if a holder made as illustrated is used. It is 1/8-in. sheet steel bent double and filed at the folded end so that a slot is formed for the pins to enter. The pins are gripped at their upper ends by squeezing the upper end of the holder as shown.—H. MOORE.



Using holder to clip five pins at once

To FINISH holes in aluminum castings larger than 2 in. in diameter, a bar fitted with cutters will generally produce a better hole than ordinary reamers. Reamers of large diameter when cutting aluminum have a tendency to clog up quickly and leave a rough hole or a poor finish.

MOTOR BARGAINS

1/4 H. P.
60 CYCLE
110
VOLT



This Convenient and Compact
BUFFER AND GRINDER

Complete as Illustrated

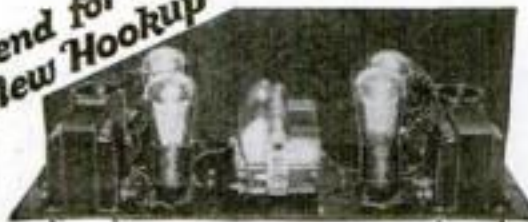
ONLY \$22.50 CASH WITH ORDER

Motor has extra size bunting bronze bearings with grease cups and filling cap. A 10 ft. cord with plug to fit any lamp socket included. Emery wheel and buffer are 6 inches in diameter, 1/2 inch thick. Emery wheel will sharpen tools quickly without burning. Shaft threaded to take a standard Jacobs Chuck for drilling purposes. Guaranteed to give perfect satisfaction or money refunded less return charges. Write for descriptive circulars and attractive price list on our complete line of Constant and Variable speed, single and three-phase Motors. All sizes. Squirrel Cage and Slip Ring types with many exclusive features. Also Martin Rotary Converters for transforming AC to DC. We have a line of rebuilt motors of all makes and sizes at bargain prices. Quantity discount on both new and rebuilt motors on request.

Northwestern Electric Co. Dept. 5, 420 S. Hoyne Ave., Chicago

The S-C SILVER COCKADAY "All Wave Receiver"

Send for this
New Hookup



Single Control—4-Tube Receiver

Designed by Silver, Cockaday and the engineering staffs of the seven manufacturers listed below. . . . Sponsored by Popular Radio Magazine. . . . Endorsed and described by Radio News, Radio Magazine, Radio Engineering, Christian Science Monitor and Newspapers throughout the country. . . . The new S-C Receiver is presented to the Set-Builder with an astounding introduction that is his best assurance of a performance that will live up to promise. . . . An introduction that compels attention and appreciation . . . that speaks volumes of praise . . . that has been accorded only to the S-C Receiver.

New S-C Features

Perfected Single Control—Unlimited Wavelength Range—Extraordinary Volume that equals that of many 6-tube receivers—Quality unsurpassed—Hair-line Selectivity that brought KFI through a blanket of powerful locals into New York City with ample loudspeaker volume. The S-C is adapted to any standard cabinets, tubes, batteries or eliminators, and to practically all installation conditions.

Assembled Easily

S-C assembled is a marvel of simplicity. A special, multi-color wiring harness eliminates soldering, unless desired, and prevents error. With only a screwdriver and a pair of pliers, even an absolute novice can assemble the S-C perfectly in a few hours.

That parts made by the following reputable concerns are recommended for the S-C by the designers is proof of its true worth:

Belden Mfg. Co.—S-C Wiring Harness.
Central Radio Laboratories—Centralab Resistance.
Polymet Mfg. Corporation—Fixed Condensers, Leak and Leak Clips.
Poster & Co.—Drilled and Processed Front Panel and Drilled Sub-Panel.
Silver-Marshall, Inc.—Variable Condensers, Coil Sockets, Coils, Tube Sockets, Vernier Dial, Mounting Brackets.
Thordarson Elec. Mfg. Co.—R200 Power Transformers.
Yaxley Mfg. Co.—Rheostat, Jacks, Switch.

Get the hand-book at your radio dealer's, or clip the coupon and send with 15 cents to

S-C MERCHANDISING COMPANY
64-66 E. Jackson Blvd., Chicago.

S-C MERCHANDISING COMPANY
64-66 E. Jackson Blvd., Chicago.

Herewith please find 15 cents for which send me the hand-book of the new S-C Four-Tube Receiver.

Name.....
Address.....



Patching Plaster

that fills cracks and holes easily and permanently

ANYONE can use Rutland Patching Plaster and make a perfect patch. Comes in handy cartons, all ready to use. Just add water.

Unlike plaster of paris, this remarkable plaster does not dry or "set" instantly. That's why it's so easy to use. The patch will not shrink, crack, crumble or fall out. You can paint or paper over it without shellacking and the patch will not "spot" through.

Paint, wall-paper and hardware stores sell Rutland Patching Plaster. If your dealer hasn't it, mail coupon. We will send you a 2 1/2 lb. carton and you can pay the postman 30c plus postage upon delivery. Rutland Fire Clay Co. Dept. R-3, Rutland, Vermont.

A few of its many other uses
Mending outside stucco or cement walls.
Pointing brick work.
Closing mouse or rat holes.
Sealing small cracks where insects or vermin enter.
As a mortar to hold loose tiles in bathroom walls or floors.



Rutland Patching Plaster

RUTLAND FIRE CLAY CO.
Dept. R-3, Rutland, Vermont
Send me 2 1/2 lb. carton of Rutland Plaster.
Name.....
Address.....
My dealer's name.....



Big Salaries Paid Automobile Experts

Fastest growing industry in U. S. A. offers unusual opportunities to trained men

THE automobile industry is one of the biggest and fastest growing industries in the United States. There are more than 18,000,000 cars registered in this country and the number is increasing every day. The best way to prepare for success in the automobile field is to study, and there is no better way to do this than through a home-study course with the International Correspondence Schools.

We say this because many of the leading figures in the automobile world today are former I. C. S. students. The list includes Jesse G. Vincent, Vice-President of the Packard Motor Car Co.; Walter P. Chrysler, President of the Chrysler Motor Corporation; E. V. ("Eddie") Rickenbacker; Hiram Walker, Chief Engineer of the Chandler Motor Car Co.; J. V. Whitbeck, President of the Cleveland Automobile Co., and other men equally as famous.

Just mark and mail the coupon and we'll send you information about the I. C. S. Automobile Courses or any other course in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7692-D Scranton, Penna.

Oldest and largest correspondence schools in the world. Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

- | | |
|--|--|
| <input type="checkbox"/> Complete Automobile Course | <input type="checkbox"/> Gas Engine Operating Course |
| <input type="checkbox"/> Automobile Electric Equipment | <input type="checkbox"/> Complete Gas Engine Course |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Radio | |

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> French | |

Name.....
Street.....
Address.....
City..... State.....
Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal

Every man should wear a "JINX"

Patented
Complete protection of watch against theft or dropping. Watch can be withdrawn only by wearer. If watch is forced the prongs on JINX grip in pocket, safeguarding watch. Sample JINX sent for 25 cents. Write for special quantity prices.

Novelty Invention Company
B. & H. Posner
1072 Bryant Avenue New York City
We need a few good men in our organization

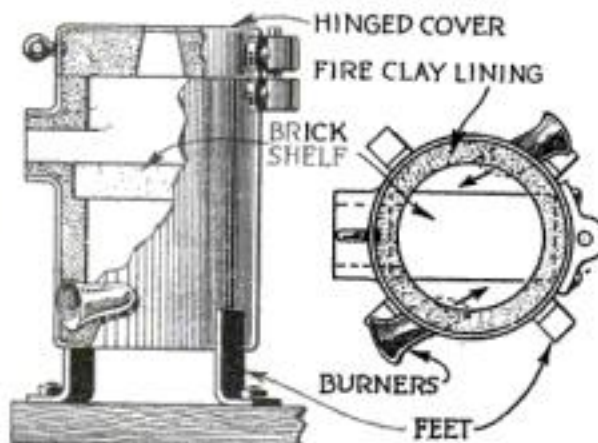
Getting Ahead?

Read the advertisements on Pages 116 to 142 this issue if you want to get ahead!

Better Shop Methods

Gas Furnace Used for Heating Tools at the Bench

THE gas furnace illustrated was made by the tool man of a small shop and is intended to be kept close at hand on the bench. The shell is of pipe with the



This small bench gas or oil furnace is a clay-lined pipe with an old brake drum for a cover

bottom and feet welded on. The cover is made from an old brake drum.

The burners, flared bell-mouthed, are welded in, and are tilted slightly so the flame follows a spiral course upward. The furnace may be used for either gas or oil by providing the proper burners.

The lining of the furnace and cover is fire-clay, carefully applied as dry as possible.—FRANK N. COAKLEY.

Universal Boring Bar Joint

WHEN a large boring bar is held in rigid alignment with steel guide bushings, trouble is sometimes experienced from binding or chafing. This difficulty is accentuated if the bar has to pass three or more bushings, as is often the case in large jigs.

The trouble frequently is traced to imperfect alignment of the guide bushings with the machine spindle. A simple remedy is to use a universal joint for connecting the bar with the spindle. This usually will overcome the difficulty and incidentally save time wasted in trying to correct the fault. The idea applies to vertical or horizontal machines.

Draftsman Uses Wedges to Aid in Drawing Threads Quickly



WEDGES to go between the head of the T-square and the drawing-board will save a draftsman's time and insure uniform angles on threads, bevels of structural shapes, and the like. They can be made in a few minutes of hard wood planed to the desired angle. Two large thumbtacks prevent them from falling out of place.—W. UHLMAN.

Makes Old Ford a Tractor

We furnish everything for converting Ford Auto Chassis with engine into a handy Farm Tractor. Just right for truck growers, small farms, nurseries, etc. Pulls 16" Plow, Discs, Seeds, Cultivates; Runs Belt Machinery. We also build Garden Tractors and Cutter Bar Mower Attachments.

Write for Free Particulars
Shaw Mfg. Co., Dept. P, Galesburg, Kan.



Squab Book FREE

Printed in COLORS. Enlarged. Much News. Squabs are raised in one month, they sell for high prices. Greatest market for 20 years. Make money breeding them. We ship everywhere on three months' trial our famous breeding stock. All prices supplies. Established 25 years. For prices and full particulars see our beautiful free book, "How to Make Money with Squabs," with pictures in colors. Write for it today. PLYMOUTH ROCK SQUAB CO. 616 N. St., Melrose Highlands, Mass.

SEND FOR THE INTERNATIONAL CATALOG

Our net price list Full line of auto bodies and accessories for Fords at Wholesale Prices. Save big money on bodies by buying Direct from Factory. FOR FORDS—Prices from \$27.85 up. Factory to consumer direct—Pay Only One Profit International Body Works, 914 W. Ohio St., Dept. 8, Chicago, Ill.



ONE DAY BATTERY CHARGING PAYS BIG

Make \$150 to \$300 monthly profits with HB One Day Battery Charging. One Day Charging demanded by auto and radio owners. Only \$35 brings complete HB outfit. 30 days trial on moneyback guarantee. Write for free Bulletin 6. HOBART BROS. CO. Box P 5, Troy, Ohio.

ONLY \$16.50 MONTHLY—

Print Your Own

Cards, stationery, labels, paper, circulars, tags, menus, book etc. Save money and time, cut cost in half. Sold direct from factory. Pays for itself in a short time. Complete Outfits, \$8.85 up. Job Press, \$12, \$35; Rotary \$150. Print for Others: Big Profits. All easy, rules sent. Write for catalog of presses, type, paper, cards, envelopes, paper cutters. The Press Co., E-33, Meriden, Conn.

BUCHSTEIN'S FIBRE LIMB

is soothing to your stump—strong, cool, neat, light. Easy payments.

Guaranteed 5 Years
Send for Catalog Today
P. BUCHSTEIN CO., 610-3rd Ave., So., Minneapolis, Minn

MOTORCYCLES

LESS THAN HALF COST
Ace, Indian, Cleveland, Harley-Davidson, Henderson Motorcycles and Sidecars, new, used and rebuilt. Riders Agents Wanted. Write for FREE trial offer, agent's free outfit and big bargain bulletin. New American Bicycles in different styles and colors. Write for illustrated catalog giving our money saving prices. AMERICAN MOTOR CYCLE CO. 2047 W. Chicago Ave., Dept. 534 Chicago

The Midget "Five-in-One" Slide Rule is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with instructions, \$1.50. Leather Case 50c extra. Sent C.O.D. if desired. Catalogue Free. GILSON SLIDE RULE CO., Niles, Mich.

\$100 in Prizes

See Cash Prize Offer on Page 4 in front advertising section

Try this Yardstick on YOUR Brain

MEASURE YOUR KNOWLEDGE with the POPULAR SCIENCE QUESTIONNAIRE

1. Why does radium continue to give out heat for thousands of years?
2. Are the stars solid like the earth?
3. How was the earth formed?
4. Why is glass transparent?
5. How do we know that the earth is slowly shrinking?
6. What is an electric current?
7. How was petroleum formed?
8. Do electrons really move through wire when an electric current is flowing through it?
9. What physical changes in your body are produced by fear?
10. How do muscles exert power?
11. What are X-rays?
12. Can we see atoms with a microscope?
13. Why does heat expand things and cold contract them?
14. Why does the moon appear to change its shape from time to time?
15. What is the brain made of?
16. Why is it possible that the inside of the earth is growing hotter instead of colder?
17. Why is frost more likely on a clear night than on a cloudy one?
18. Does thinking use up the thinker's energy?
19. Which travels faster, electricity or light?
20. What simple test will distinguish wool from cotton?
21. What makes the noise of thunder?
22. Why would men ultimately suffocate if all the green plants were killed?
23. Does the boiling of water remove the impurities in it?
24. How do the living cells of the body get the energy with which to do their work?
25. How is the speed of light measured?

TOTAL PERCENTAGE

EVERYBODY is talking about the famous "Popular Science Questionnaire." Doctors, Lawyers, Professors, College Graduates and thousands of others have tested themselves with this Questionnaire. In the panel is the list of questions of which the Questionnaire is composed. How many of them can you answer?

Like an Old-fashioned Examination

May we ask you to make this test carefully, reading the questions slowly and giving thought to each one? When you cannot answer one satisfactorily to yourself, put a zero (0) beside it.

On the other hand, give yourself credit of four (4) for each satisfactory answer. Then when you are through, see how near you have come to making a mark of 100.

This is like an old-fashioned examination, but you will find it fascinating. The questions all have to do with the wonders of the world we live in. All can be given quick and straight forward answers by any person of education.

All of the questions in the famous "Popular Science Questionnaire" and many hundreds of others, have now been answered, for the first time, in one book—THE POCKET GUIDE TO SCIENCE.

All that you probably ever will want to know about science is told in this one 284-page book that will fit in your pocket or grace a library table. Curiosity-satisfying facts about the world we live in are made instantly available to you in simple question-and-answer form in THE POCKET GUIDE TO SCIENCE.

You are assured of the accuracy of the answers in THE POCKET GUIDE TO SCIENCE because it has been edited by

Dr. E. E. Free, who has remarkable genius for condensing the known facts about scientific questions into easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is offered to you without one penny extra cost with a 14 months' subscription to POPULAR SCIENCE MONTHLY.

POPULAR SCIENCE MONTHLY "carries on" from where THE POCKET GUIDE TO SCIENCE leaves off. THE POCKET GUIDE gives you all that the scientists have discovered up to right now—POPULAR SCIENCE MONTHLY will give you all the important, interesting and new discoveries of science for the next 14 months.

It takes over 300 articles and pictures every month to tell the readers of POPULAR SCIENCE MONTHLY all that has happened in the scientific, radio, mechanical and automotive fields.

Your Name in Gold

THE POCKET GUIDE TO SCIENCE is bound in beautiful flexible fabrikoid. We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE at no extra cost to you if you use the coupon below immediately.

We extend to you the Special Offer of a 14 months' subscription to POPULAR SCIENCE MONTHLY (regular price by the month would be \$3.50) with the THE POCKET GUIDE TO SCIENCE—all for \$2.95, plus the postage. If you are already a subscriber to POPULAR SCIENCE we will extend your subscription 14 months if you accept this offer.

Into this one brilliant book of 284 pages has been condensed the outstanding facts about the world we live in.

SEND NO MONEY

Send no money, just the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular, you may return them, and your entire payment will be refunded promptly and without question. Could any offer be fairer?

POPULAR SCIENCE MONTHLY
250 FOURTH AVENUE NEW YORK

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman \$2.95, plus the postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY. If the book and magazine are not fully satisfactory to me I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold.

Name

Address

City

State

If you prefer send \$2.95 with your order

P. S. 5-26



There's A "RADIO" Bungalow In The Size You Want!

THESE wonderful Summer bungalows are now made in 6 sizes, varying from 3 to 5 rooms with porch.

INTRODUCED for the first time last summer, the Bossert "Radio" Bungalow sprang into instant popularity among vacationists everywhere. Whether for seashore or mountains, the "Radio" is the ideal type bungalow.

IT is easily erected by unskilled labor within a day and a half. Being really portable it can be taken down quickly and put up again without trouble. Sturdily built, lasts for years. Immediate shipment.

Send 20c for our new 48 page catalog

F. O. B. BROOKLYN

Priced from **\$500 to \$870**

"RADIO" Garage

Only

\$295 F. O. B. Brooklyn



Handsomely designed. Comes sectional-built; 12 ft. x 18 ft. inside measurements. Strongly constructed. An attractive addition to any home or estate. Can be erected by unskilled labor in 8 or 10 hours. Carried in stock for immediate shipment.

LOUIS BOSSERT & SONS, Inc.
"Largest Lumber Plant in the East"
1310 Grand St. (House Dept.), Brooklyn, N. Y.

The Greatest Sea Rescue

(Continued from page 13)

snapped the line! In desperation, the rescuers tried to send lines over by tying them to floating casks; but the breakers swept the casks out of reach.

It was at this desperate point that Chief Engineer Turner, searching his mind, hit upon an idea from the experiences of his boyhood. He built a kite seven feet high and four feet wide, with two wooden crosspieces covered with oiled linen. For his string he found a ball of stay lace used for engine packing.

"WE'LL fly the kite from the deck," he told his men, "and when it is well up and beyond the *Antinoe*, we'll drop it by suddenly paying out the string. The string will fall on the *Antinoe's* deck, and her crew can haul it in."

That this idea was a thoroughly practical one was vouched for a few days ago by Dr. Miller Reese Hutchison, consulting engineer of the Naval Consulting Board, when he proposed a combination kite and breeches buoy device as a substitute for the Lyle gun. Only instead of dropping the kite, as Turner proposed, Dr. Hutchison would pay out heavier and heavier line, making the kite drag it along until it touched the side of the derelict vessel. Then, with the aid of this line, it would be possible to pass from one vessel to the other the cable for an ordinary breeches buoy strung between the cargo masts of the two ships.

TURNER'S kite, however, was not flown during the rescue, although it was tried out later by a number of the passengers. In its place the engineer hit upon another idea.

It was apparent that the projectile, on leaving the gun, did not speed away on an even keel, nose first, but turned end over end through the air. Would not the sudden jerking strain on the line be relieved if the length of the spindle were increased, thus making the projectile swing in a wider arc? And why not further relieve the jerk by means of a spring? It so happened that among the passengers on the *Roosevelt* was an American artillery officer, Colonel Clint C. Hearn, an expert in the science of ballistics. With him Turner discussed his idea, and then turned again to his machine shop.

This time he made the spindle four feet long instead of eighteen inches. He made a spring of brass eighth-inch wire which he wound into a spiral over a bar revolving in the lathe. One end of the spring he fastened in the eye of the spindle. The other formed a loop for the shot line.

When the shot was fired, the spring eased the jerk, and the line held. And so out of the stress of grim necessity was born a worth-while invention.

A few days after the return of the *President Roosevelt*, I visited the Brooklyn home of the ship's chief engineer. There I found him in the throes of building a radio set. Wires and solder and batteries were scattered about. He had burned a hole in the rug with acid, and his good wife was scolding him roundly.

"You see," he chuckled, "I'm just getting in practice for another *Antinoe*."



Boys!

Did You Know

That you can get Boston Garters made specially for you? In every particular, just the same as Dad's, except that in size they are adapted to those of you beginning your first long trousers.

Bostons are preferred by men who know good garters because they look better, wear better and feel better.

For those who wear knickers, ask for the Knicker Boston Garter.

George Frost Company, Makers, Boston

Amaze Your Friends With Chemical Tricks

The Boy's Handbook of Chemistry
Price 15 Cents

Write secret letters with invisible ink; pour blue, brown and black liquid from a glass of water; make a magic pitcher of bluing; make your own magic writing paper, your own ink and dyes. It's all easy if you have Chemcraft Junior—the pocket Chemical outfit. Get yours now. Order right away and get a FREE Copy of The Boy's Handbook of Chemistry; 100 pages of experiments, formulas, interesting chemical information, money-making suggestions and catalog of supplies.

CHEM-CRAFT JUNIOR
CHEMICAL OUTFIT
PRICE 25 CENTS

BOTH 25c
THE PORTER CHEMICAL CO.
115 Washington St.
Hagerstown, Md.
POSTPAID

"DON'T SHOUT"



is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

Coil Spring Moth Ball Holder

A HANDY SPIRAL CONTAINER with removable cover. This simple device can be hung on clothes-hangers or behind the door-lamb, where its action is very effective in making the whole closet moth-proof. A box of moth balls will fill eight (8) holders. Price \$1.50 per dozen. Discount to agents in gross lots.

R. J. LEWERS
1888 Cedar Ave. New York City

What Could You Do with \$50—?

See the Cash Prize Offer on Page 4.

DIAMONDS

LOFTIS

BROS. & CO. 1838
The Old Reliable Original Credit Jewelers
Dept. N-871 108 N. State St. Chicago, Ill.
Stores in Leading Cities

CASH or CREDIT

It's Easy to Own a Genuine Diamond Ring
Our immense stocks include thousands of the latest mountings in platinum and solid gold, all set with brilliant blue white Diamonds of exceptional quality. Order today and get your ring at once. Pay 10% down—we ship goods immediately. Balance weekly, semi-monthly, or monthly as convenient.
Big Diamond Book FREE! Write for It Today!

No. 28
\$37.50
\$1.00
a wk.

No. 31
\$187.50
\$4.70
a wk.

No. 27
\$69
\$1.75
a wk.

No. 30
\$97.50
\$2.45
a wk.

Wedding Rings
No. 824—The "Elite" \$7.50
18-k white gold.
Set with 3 Diamond's, \$22.50;
5 Diamonds, \$32.50; 7 Diamonds, \$42.50; 9 Diamonds, \$52.50; 12 Diamonds, \$67.50.

17-Jewel Elgin
No. 15—Green gold, 17-Jewel Elgin Watch; 25-Year Quality Case; 12 Star; Gilt Dial; \$50.
\$3 down and \$1.00 a week.

Wrist Watch
14-k white gold, hand engraved case. Fancy wing ends. Silver dial. High grade 15-Jewel movement. \$25. \$2.50 down and \$1.00 a week.

Can You Solve the Greatest Puzzles?

(Continued from page 24)

a square box in regular order, excepting the 14 and 15, which were transposed. The puzzle called for the moving of the blocks through the medium of the vacant square, with the object of bringing them into regular sequence, with the 15 the final number, as in the diagram.

LUDICROUS tales were told of the havoc this puzzle wrought in all parts of the world. Although thousands claimed to have solved the puzzle, no one could recall the sequence of moves whereby the feat was accomplished, and none of the alluring prizes offered for the solution ever was collected. The puzzle is unsolvable, for the reason that when the 14 and 15 are reversed, compensation must be made by reversing two other blocks.

The Pigs in Clover puzzle which in the 'eighties succeeded the "14-15" as a world disturber, was, strictly speaking, not a problem, or puzzle, at all. It consisted of a circular cardboard box filled with a series of partitions, having openings through which a number of marbles were made to pass by shaking and inclining the box, the object being to drive all of the marbles into a central pen. It was designed as a child's toy, but proved to have such alluring qualities that grown-ups became absorbed in the pastime.

In the sequence of world-famous puzzles, my Missing Chinaman puzzle, which made its appearance in 1896, next caught the popular fancy. Many readers undoubtedly will greet this puzzle, which is reproduced at the top of page 24, as an old friend. Those who are not familiar with it, I am sure, will be repaid if they cut it out of the magazine according to directions and attempt its solution.

I introduced this puzzle primarily as an advertising novelty. My first large customer was Carl Laemmle, now a well-known motion-picture producer, then manager of a department store in the Middle West. Among others who used the puzzle for advertising purposes was the campaign manager for William McKinley in the latter's race for the presidency against William Jennings Bryan in 1896. A million of these puzzles were distributed that year in the interest of the Republican candidate.

IT MAY interest movie fans to know that when I showed this puzzle to Mary Pickford a few years ago, this sharp-witted little lady, who, like her husband, Douglas Fairbanks, is a good puzzler, after a period of concentration on the shifting circle, proved herself a better solver than untold thousands of other puzzlers by correctly answering the question, "Which man disappears?" Her reply to the puzzle's secondary query, "Where does he go?" proved to be too complex for mental assimilation by any member of her gallery. See how well you can do with this puzzle.

Another puzzle that attracted wide attention, which I first brought out in 1900, is that of the Three Houses and Three Wells. You'll find this puzzle on page 24. I unhesitatingly nominate this as my "best puzzle," on the score of in-

genuity and its interest appeal to puzzlers. It seems to enjoy perennial popularity. Notwithstanding that it has a perfectly fair answer which I have published repeatedly, seldom a day passes without somebody writing to ask if it can really be done. These requests have come from all parts of the world, and for years I have kept the solution in printed form to take care of the numerous inquiries.

THE Clock Dial puzzle, which is reproduced on page 24 is another whose popularity has never waned. Requests for the solution have reached me almost daily since I introduced it in 1909. See whether you can work it out.

The arrangement of numbers in the form of squares so that they will add up to the same total in every column and row as well as in the two diagonals is without doubt the oldest of all mathematical puzzles. "Magic Squares," as these arrangements are called, were held in veneration by the Egyptians, who imputed to them real magical power, and to this day Chinese and Korean soldiers carry charms in the form of magic squares to protect their lives. An interesting puzzle based on the magic square principle is presented on page 24.

It is astonishing and amusing how frequently this puzzle is rediscovered by modern mathematicians. Scores of times this old puzzle has been offered to me for exploitation by sincere persons, who happen to be several thousand years late with their inspiration.

FROM time to time I have originated mathematical problems based on a complication of facts concerning ages. These usually can be solved best by algebra. The most popular of these was the following, which I present in its original wording:

How Old Is Ann?

Johnny had a working agreement with his sisters covering the suppression of family history, so when the census man inquired as to the ages of Mary and Ann, Johnny clouded statistics in the following truthful statement: "The combined ages of Mary and Ann are 44 years, and Mary is twice as old as Ann was when Mary was half as old as Ann will be when Ann is three times as old as Mary was when Mary was three times as old as Ann."

How old is Ann?

Can you figure it out? It's really not so complicated as it sounds—if you go at it quietly and unhurriedly. Anyway, I am going to give you the answer, and the solutions to the other puzzles I have presented here, and tell you some more about puzzling, in the next issue of POPULAR SCIENCE MONTHLY.

This is the first of two intriguing articles in which Sam Loyd relates the experiences of a lifetime of "puzzling," and presents for solution the puzzles which he regards as his best. The second will appear in our June issue.

21 Jewel Burlington



LOOK!

Adjusted to the Second
Adjusted to Temperature
Adjusted to Isochronism
Adjusted to Positions
21 Ruby and Sapphire Jewels
25 Year Gold Strata Case
Your choice of Dials
(Including Montgomery Railroad Dial)
New Ideas in Thin Cases

**Only \$1.00
Down**

Only One Dollar Down will buy this masterpiece of watch manufacture. The balance you are allowed to pay in small, easy monthly payments. The Burlington—a 21-Jewel Watch—is sold to you at a price much lower than that of other high-grade watches. Besides, you have the selection of the finest thin model designs and latest styles in watch cases. Don't delay! Write for the FREE Watch Book and our Special Offer today.

Write
While this Special Offer Lasts

Get the Burlington Watch Book by sending this coupon. Find out about this great special offer which is being made for only a limited time. You will know a great deal more about watch buying when you read this book. You will be able to "steer clear" of the over-priced watches which are no better. Remember, the Burlington is sent to you for only One Dollar down, balance in small monthly payments. Send the coupon for watch book and our special offer Today! Do not delay one minute!

Burlington Watch Co., Dept. 13.65
19th St. and Marshall Blvd., Chicago, Illinois
Canadian Address: 62 Albert St., Winnipeg, Man.


Please send me (without obligations and prepaid) your free book on watches with full explanation of your \$1 down offer on the Burlington Watch.

Print name and address plainly

Name _____

Address _____

Money Making Opportunities for "Popular Science" Readers



Readers of POPULAR SCIENCE MONTHLY will find scores of opportunities in this section (pages 116 to 142) for making more money.

RAILROAD FARE TO CHICAGO Included Without Extra Cost If You Act RIGHT AWAY!



as Taught in COYNE Shops

**Puts You In the
Big-Pay Class
Quickly!**

HUNDREDS OF
COYNE-TRAINED
MEN EARN
\$60 to \$200
A WEEK!

**RAILROAD
FARE TO
CHICAGO**
included with-
out extra cost
if you act AT
ONCE. Get full
particulars be-
fore this amaz-
ing offer is with-
drawn.



Students
Constructing Outdoor
Substation at COYNE

**You Don't Need
Advanced Education
or Experience to
Learn at COYNE**
Every COYNE student
receives INDIVID-
UAL and PERSONAL
instruction, on COM-
PLETE electrical ap-
paratus, under EXPERT
INSTRUCTORS, in
the COYNE Shops at
Chicago.

Send for Big FREE Book!
Send for a copy of
my big, attractive Elec-
trical Book. It is 12x15
in size. Contains 151
photos of electrical
scenes, dynamos,
radios, autos, airplanes,
farm lighting and
power, etc. Absolutely
FREE.



**Earn While
You Learn
at COYNE.**
My Employment
Department will
help you.

Students pro-
ducing "artificial
lightning" on
Tesla coil in
great shops of
Coyne

Students
operating
large switch-
board at Coyne



Student Winding Stator at COYNE

COMPLETE ELECTRICAL TRAINING

In 12 Happy Weeks at COYNE

My newly enlarged
Electrical Course is the
result of 27 years of expe-
rience, solving the needs
of young men and of the
Electrical Field. COYNE
has been teaching Elec-
tricity in a PRACTI-
CAL way since 1899.
My course is thorough,
easy to master, and fits
men for BIG Electrical
jobs, the HIGH-SAL-
ARIED thrilling jobs.



H. C. LEWIS
President, Coyne
Electrical School

We Teach Electricity and Nothing Else

COYNE teaches only ONE thing—
ELECTRICITY. We are SPECIAL-
ISTS. Our interests are not divided,
nor is Electricity a sideline or
merely an "additional" sub-
ject with us.

**You Can Start Any Day of
the Year at COYNE—No
Classes or Seasons. Get the
Coupon Mailed Right Away
so that You May Read Full
Particulars of My Course.
My Big FREE Book will
Amaze You!**

Tune in on COYNE Radio Station WGES

COYNE

ELECTRICAL SCHOOL

H. C. LEWIS, President Established 1899
1300-10 W. Harrison St. Dept. 1365 Chicago
There is no Substitute for Personal Training, in
Great Shops, on COMPLETE Apparatus

Do You Need a Self-Starter?

(Continued from page 4)

Dear Sir:

Whenever I come to the advertisement in the Money-Making Opportunities Section referring to the National Salesmen's Training Association, I always pause to express my respect for that Institution.

About a year ago I investigated the merits of the school to see what it could do for my step-brother, and was so pleased with the thorough manner in which a novice is drilled in the principles of the art of salesmanship that I immediately enrolled my brother, making the payments out of a meagre teacher's salary. (Continued on page 117)

\$100 in CASH PRIZES

For the best letter of 150
words or less answering
the question—

*"What advertisement in
the 'Money-Making Op-
portunities' Section inter-
ests you most—and why?"*

we will pay on June 10th
the following—

CASH PRIZES

First Prize	\$50.00
Second Prize	25.00
Third Prize	10.00
Fifteen Prizes of \$1.00 Each	15.00

First read every advertisement
in the Money-Making Oppor-
tunities Section on pages 116 to
142. Pick out the one that in-
terests you most and then write
a letter—not exceeding 150 words
—telling us why you find the
advertisement you have selected
the most interesting.

Entries for the contest will
close on May 1st. The prize
winners and their letters will be
published in the July issue of
POPULAR SCIENCE MONTHLY.

Address your letter to
Contest Editor

MONEY-MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

SEND COUPON NOW

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
1300-10 W. Harrison St.
Dept. 1365, Chicago, Illinois

Dear H. C.—Send one of those big,
handsome FREE 2-color books, with 151
photographs. Be sure to tell me all about
R. R. Fare Offer and Special Courses with-
out extra cost.

Name.....
Address.....

Do You Need a Self-Starter?

(Continued from page 116)

The ability to emphasize the merits of a product, to persuade, to convince, to be honest, straight-forward, and upright—in short, all the tools that go to make not only a good salesman but also a better citizen and home maker are now my brother's for the rest of his life.

Little wonder, indeed, that I highly esteem the N. S. T. A.

AUGUST P. HERDTFELDER,
Romney, West Va.

A man, who is in a position to know, tells us what he thinks of one of the "Money-Making Opportunities." Perhaps you are one of the thousands he refers to in this letter:

Dear Editor:

Under "Business Opportunities" I notice an opportunity which thousands need.

A. Allard of Montreal, Canada, offers to those who are seeking a better position a letter of application and instructions how to sell their services—all for \$1.00.

As a supervisor, connected with one of the largest employment organizations in America (The Western Electric Company, Chicago) I know that many persons fail to get a reply to their application because it is poorly worded and does not sell their services.

There are many good correspondents who, like Mr. Allard, could turn their ability into cash by advertising their services in POPULAR SCIENCE, and there are many good people who could secure better positions by using the services of people like Mr. Allard.

G. H. BENNETT

A very interesting letter, that we are printing below, comes from a Preparatory School Instructor who has not only taught English to his pupils but also instructed them as to the ways and means of making money. This is what Mr. Lyon says:

Contest Editor:

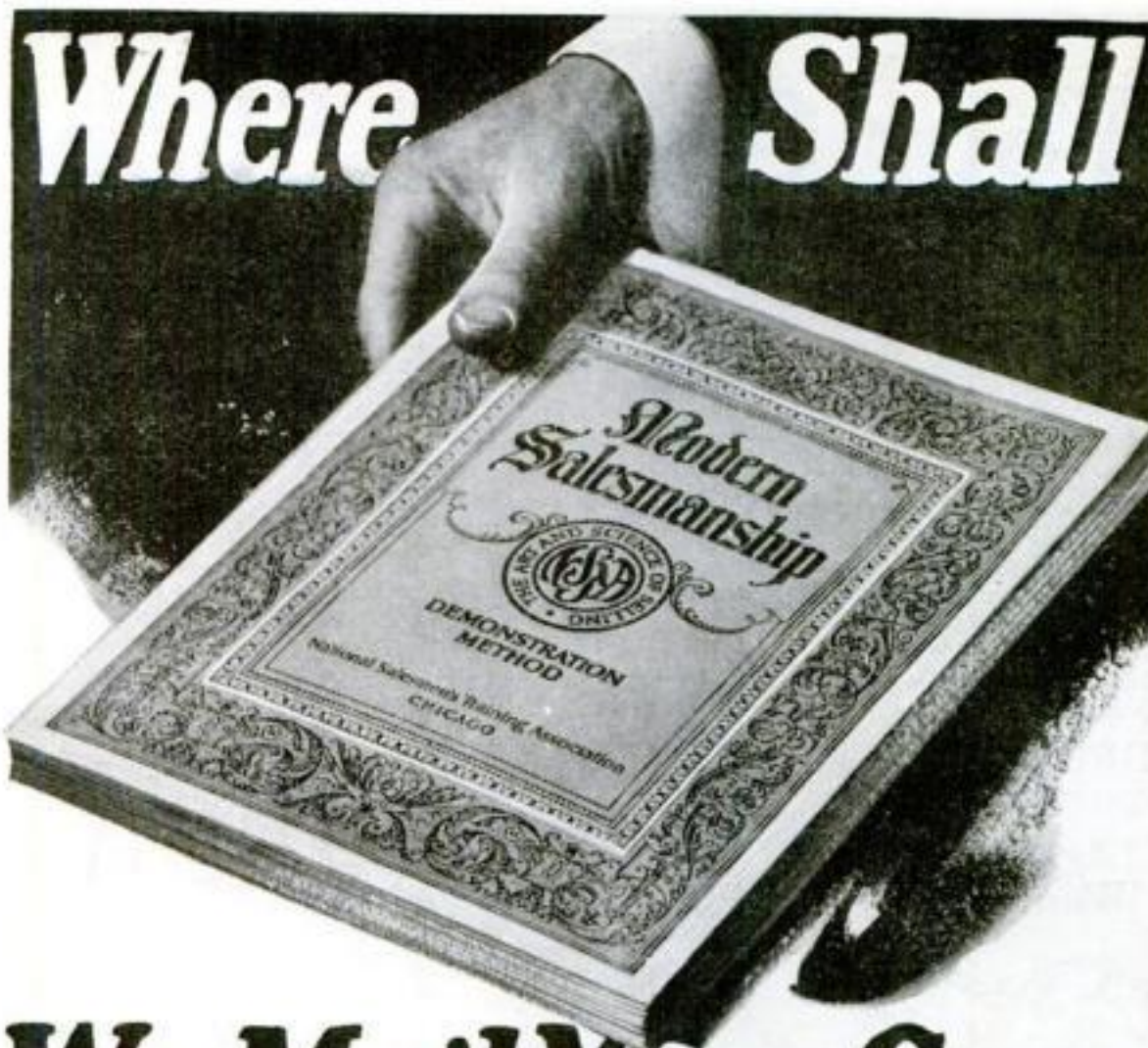
Some of the advertisements in your Money-Making Opportunities Department of POPULAR SCIENCE MONTHLY have been of special interest to me. This is not so much because I have made money by them myself, as because I have enabled others to do so. This seems to be the ironical lot of the teacher to tell others how to make money. Isn't it true?

As English instructor in a large preparatory school in the heart of Pittsburgh's industrial and commercial district, I get a good many students of a decidedly mechanical turn of mind, some of whom are working on useful inventions. I have been able to call the attention of a number of these students to the advertisements of a number of reliable patent attorneys, such, for example, as Clarence A. O'Brien, page 143 of your March issue.

We have plenty of good patent attorneys in Pittsburgh but many of them handle the big local cases with correspondingly big fees, so I have found that some of my students hesitate to approach high-fee attorneys with their patentable ideas for fear the ideas may not be received favorably, as unlikely to promise big results. These are the students that I have been pleased to direct to such reliable patent attorneys as Mr. Clarence A. O'Brien of Washington, D. C.

GEORGE W. LYON

(Continued on page 118)



We Mail Your Copy of This Book-FREE

Remarkable new book on Salesmanship just off the press will be mailed to you without cost or obligation

THE contents of this amazing new book—just published by the National Salesmen's Training Association—will prove a revelation to every man who is interested in making real money—and to those who realize the tremendous possibilities for high earnings in the selling field.

Thirty thousand copies of this book will be mailed free without cost or obligation to those who send for it while the supply lasts.

FULLY EXPLAINS NATIONAL DEMONSTRATION METHOD

Thousands have wondered why N. S. T. A. Members invariably make good, in a big way, right from the start, even though they have had no former selling experience, or why salesmen who have just plodded along with indifferent success quickly begin to outstrip their brother salesmen after becoming members of the Association.

Among other things, this remarkable free book explains just why success comes rapidly and surely to those who enroll for this amazing System of Salesmanship Training.

QUICK SUCCESS THROUGH N. S. T. A. TRAINING

Whether you have had selling experience or not, it makes no difference. The N. S. T. A. System of Salesmanship Training will enable you to become a Master Salesman in an amazingly short period of time. It will teach you, in your spare time, at home, the fundamental rules and principles of selling—how to approach different types of prospects to get their undivided attention—certain ways to stimulate keen interest—ways to overcome objections, batter down prejudices, outwit competition, and make the prospect act.

Step by step this Training takes you through every phase of Salesmanship. Every underlying principle of the sales strategy is made as simple as A B C. Through the National Demonstration Method, you get actual experience on practically every type of sales problem that may ever present itself. And through the instruction in Character Analysis you will become an expert in reading character on sight—a valuable asset for any salesman.

EMPLOYERS

are invited to write to the Employment Dept. of the N. S. T. A. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of Instruction for entire sales forces. Synopsis and charts sent without obligation.

TYPICAL EXAMPLES OF SUCCESS

When A. H. Ward, Chicago, returned from the war he was making \$20 a week. He enrolled with the N. S. T. A. and last year earned \$13,500 and was elected an officer of Post's, Chicago. J. H. Cash, Atlanta, Ga., jumped from \$25 a week to \$500 a month. M. V. Stephens, of Albany, Ky., earned \$25 a week when he enrolled. His last report showed he was earning \$125 a week. O. H. Malfroot, Boston, Mass., stepped into a \$10,000 position as Sales Manager—so thorough is this training.

You will find hundreds of similar success stories in our Literature—successes you can easily duplicate.

BIG DEMAND FOR TRAINED SALESMEN

City and traveling sales positions are open in every line all over the North American continent. For years thousands of leading wholesalers, jobbers, and manufacturers have called on the Association to supply them with salesmen. Employment service is free to both employers and members, and thousands have secured positions through this service. Surely this is a glowing tribute to the thoroughness and practicability of our System of Salesmanship Training and Employment Service.

JUST MAIL THE COUPON THE BOOK IS FREE

To fill in and mail the coupon will not obligate you in any way, but it will show you the way to be a "star" salesman. It will pay you to let us send you this valuable and interesting book. Fill in and mail the coupon and get it into the mail sometime today.

NATIONAL SALESMEN'S TRAINING ASSOCIATION
WORLD'S OLDEST AND LARGEST SALES TRAINING INSTITUTION
Dept. E-15, N. S. T. A. Bldg., Chicago, Illinois

National Salesmen's Training Ass'n,
Dept. E-15, N. S. T. A. Bldg., Chicago, Ill.

Without cost or obligation you may send me your free book, "Modern Salesmanship," and details of your System of Training and Free Employment Service.

Name.....
Address.....
City..... State.....
Age..... Occupation.....

Your Own Snug Little Shop

with a "LITTLE SAVAGE GRINDER"

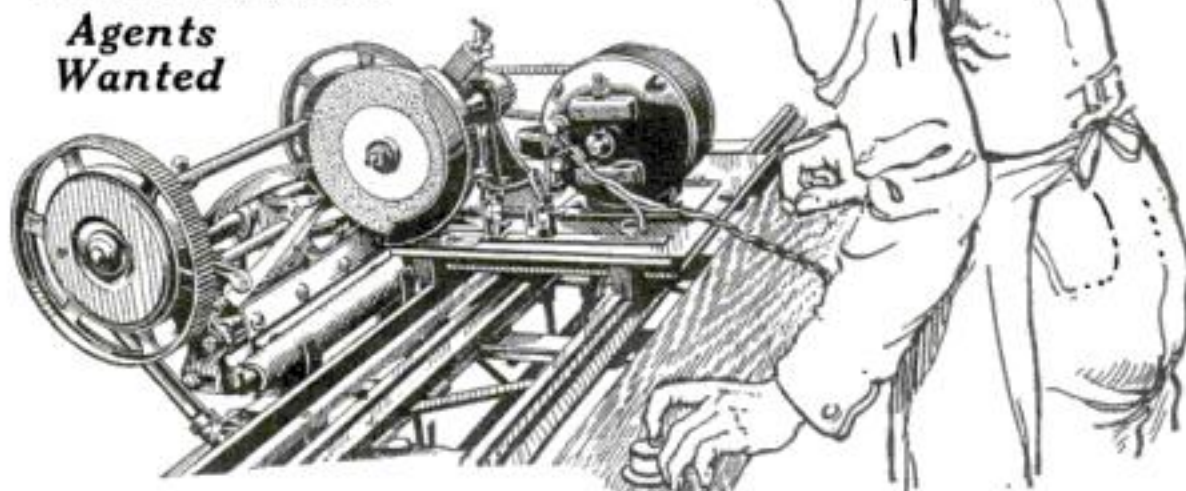
One Man **\$1,000** Reports

Made Within a Few Weeks
Under Our Wonderful New
Big Profit Plan, Sent FREE!

BE YOUR OWN BOSS! Know the joy of manly independence. BE FREE! Come and go as you please. SHARP-EN Lawn Mowers, Paper Cutter Knives, Planer Knives, Cutlery, Skates, Make Keys—every household, every store is your customer. Permanent, pleasant, easy business. And your own snug little shop! Write today for our Big Profit Plan—it's FREE. Just address

BROWN MACHINERY CO.
GREENEVILLE, TENN.

**Agents
Wanted**



**Sure, Steady
Quick, Easy
Profits**

COPY THIS SKETCH

and let me see what you can do with it. Cartoonists trained by this school are earning from \$50.00 to \$200.00 or more per week. The London Picture Chart Method of teaching makes original drawing easy to learn at home in sparetime. Send sketch with 6c in stamps for full information and sample chart to test your ability. Please state age.

THE LONDON SCHOOL
1451 National Bldg. CLEVELAND, O.



STUDY AT HOME

Directed by

The University of Chicago

Courses in English, History, Chemistry, Business, Mathematics, Education, Psychology, and 35 other subjects command credit toward a Bachelor degree. Begin any time. Address 25 Ellis Hall, University of Chicago, Chicago, Ill.

Do You Need a Self-Starter?

(Continued from page 117)

Decide now what you want to be in life. Read carefully *all* the advertisements on pages 116 to 142. Then fill in the coupons or write the advertisers you select as being most interesting. These advertisers are ready and willing to help you. The booklets and other information they will send you will be extremely interesting and of great importance to your future.

Complete List of PRIZE WINNERS In the March Contest

FIRST PRIZE \$50

Mrs. A. Lundeen, Forest Lake,
Minn.
(Coyne Electrical School)

SECOND PRIZE \$25

Clarence M. Minott, Bangor, Maine
(International Correspondence
Schools)

THIRD PRIZE \$10

A. P. Herdtfelder, Romney, W. Va.
(National Salesmen's Training
Assoc.)

PRIZE WINNERS who receive \$1.00 each for their letters

Harold W. Leath, Fort Collins, Colo.
(Mokane Institute)

G. H. Bennett, Milwaukee, Wis.
(A. Allard)

F. E. Rising, San Anselmo, Calif.
(Coyne Electrical School)

James A. Melton, Dixon, Ky.
(Literary Bureau)

J. D. Calvert, London, Ontario, Can.
(Stephenson Laboratory)

Earl C. Cooper, Athens, Ohio
(American Technical Society)

L. A. W. Johnson, Ashland, Wis.
(Prof. Henry Dickson)

Frank G. Davis, Harrisonburg, Va.
(W. L. Evans School of Cartooning)

Wallace Hamilton, California, Pa.
(National Radio Institute)

George W. Lyon, Pittsburgh, Pa.
(Clarence A. O'Brien)

Cono Puglisi, Tampa, Fla.
(American School)

Anna M. Dempsey, Los Angeles, Calif.
(Sherwin Cody School of English)

H. E. Howe, Glencoe, Minn.
(North American Institute)

N. H. Caskin, Marietta, Ohio
(International Correspondence Schools)

E. L. Maffitt, Oakville, Iowa
(Clarence A. O'Brien)

A BETTER JOB NOW - FOR YOU

Earn \$2,000 to \$10,000 a Year!

Why work for small pay? Learn a good trade. Know autos—how to repair them. Get a better job—Now! Or a business of your own. Learn in a few weeks here at the great auto-trade school in the heart of the auto industry. Think of the repair work on eighteen million cars! There are not nearly enough trained men to do this work. **TRAINED Auto Men Are Wanted!** You can be a skilled mechanic and auto electrician and **Earn Big Money.** Experience not necessary. If you are mechanically inclined come to Detroit now to the Old Reliable "Michigan State."

Learn Autos in Detroit THE HEART OF THE INDUSTRY

Here you have wonderful advantages. Study autos, trucks, engines, auto electricity, tractors. All on best equipment, up-to-date. Many new cars including Packard "Straight Eight" with four wheel brakes, Buick Six (four wheel brakes), Oakland (four wheel brakes), new Oldsmobile, Hupp, Reo, Hudson, many others. Hundreds of engines and electrical systems. Expert instructors to teach you; a thorough course that slights nothing.

Visit the great plants of Ford, Cadillac, Packard, Lincoln, Dodge, Hupp, Hudson, Studebaker, many others. These great companies endorse this School. Get factory endorsed training at Detroit, the Auto Center. **Good Positions Open.** Here's your chance to be independent. The demand for trained auto men is greater than the supply. Opportunities everywhere. Write today for full information about Detroit training to make the most money.



Michigan State Automobile School
585 Auto Building Detroit, Michigan

GET THE FACTS - TODAY!

MICHIGAN STATE AUTOMOBILE SCHOOL,
585 Auto Building, Detroit, Mich.

Send me FREE and without obligation complete information about Detroit training to make the most money.

Name

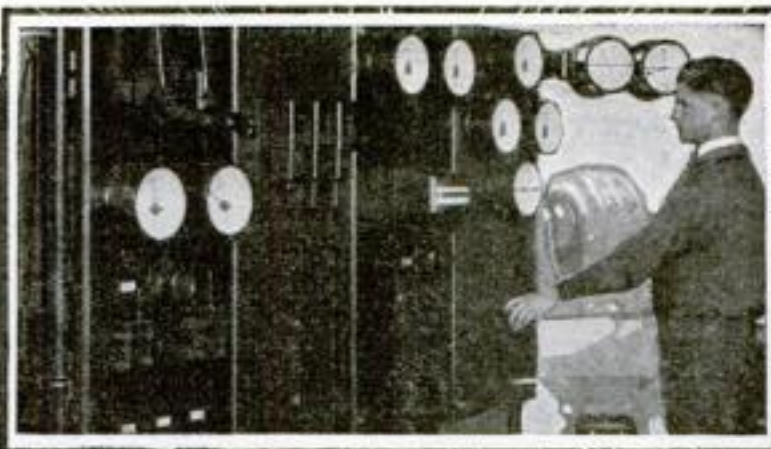
Street or R. F. D.

City State

I am interested in ☐ Resident Course at your school.
☐ Home Study Course.

**Thousands
of COOKE
Trained Men**

**Earn
\$3500 to
\$10000
a Year**



\$125 a Week "Depend on me as a booster," says A. Schreck, Phoenix, Arizona. "I make over \$500 a month. Your advertisement started me to success."

800% Pay Increase "I now make eight times what I earned when I enrolled. I used to get \$50.00 a month; now it's \$400." Carroll Moeschler, Chaska, Minn.

**Get Ready NOW
for a Big Pay Job
in Electricity—Be An**

ELECTRICAL EXPERT

**I Will Train You AT HOME
In Your Spare Time**

Don't you keep on working for only \$25 or \$35 a week. Get into Electricity. Thousands of Cooke Trained Men who knew nothing about it a short time ago are now earning \$70 to \$200 a week as Electrical Experts—and they don't work half as hard as you do. Why stick to your small pay job? Why stick to a line of work that offers no chance—no promotion—no big pay? Get into the world's greatest business. Electricity needs you. I'll show you how to do it. Get ready for the big pay job now.

Electrical Experts Are In Big Demand

Even ordinary electricians—the "screw driver" kind—are making big money, but trained men—Electrical Experts who get the top salaries—are needed more now than ever before. Thousands of Cooke Trained Men easily earn \$3,500 to \$10,000 a year. That's the kind of a job you want—where you can plan and boss and supervise the work of others or go into business for yourself. Get started towards one of these big-pay jobs now. Learn to earn \$70 to \$200 a week—you can do it with Cooke Training—recommended by more than ten thousand successful graduates. Just mail the coupon below.

Age or Lack of Experience Bars No One

You don't need experience. You don't have to be a College man. You don't have to be even a high school graduate. As Chief Engineer of this big two million dollar institution which does a general Consulting Engineering Business besides operating one of world's greatest Training Schools, I know just what training you need to make a big success in electricity. Let me give you that training with my simplified, complete home course—the world famous "Cooke Training"—built on my own 20 years of engineering experience with the help of nearly 50 other engineers. Learn to earn \$70 to \$200 a week—only spare time needed.

Employment Service—No Extra Charge

I will train you for a big pay job and then help you get it without extra charge. Hundreds of Employers look to me for the electrical men they hire. Last year I placed over one thousand men at big raises in pay. Hundreds of others were promoted by their employers through the help of my Vocational Service and other hundreds went into business for themselves with the help of my special Business Training. Mail Coupon for big free book which explains this service and fourteen other features, many of which can't be had anywhere else.

My Training Pays For Itself

You can start earning extra money a few weeks after you start my training. I give you special instruction for doing simple electrical jobs in your spare time—show you how to get those jobs and tell you what to charge. Many of my students make as high as \$25 a week extra this way while studying. My course more than pays its own way.

Your Satisfaction Guaranteed

I am so sure I can make you a big success in Electricity, just like I have done for the men whose pictures you see here and thousands of others who now boost my training, that I will guarantee your satisfaction with a signed, money-back guarantee bond. If my training doesn't satisfy you after you have finished, you get back every penny you pay me. A two million dollar institution stands back of this guarantee.

Get Started Now—Mail Coupon

Get my big free book—"The Vital Facts about Electricity." Read about the careers of hundreds of other men—men who recommend this training and whose names and addresses are given in my book. Get the real dope about your opportunities in Electricity. See how easy it is to get started—on the road to jobs that pay \$70 to \$200 a week. Don't deny yourself this chance to make big money. Get the facts now—Mail coupon at once for facts and my guarantee.

**L. L. COOKE, Chief Engineer
CHICAGO ENGINEERING WORKS, Inc.**

**Dept. 35
2150 Lawrence Ave.
Chicago, Illinois**

**L. L. COOKE, Chief Engineer,
CHICAGO ENGINEERING WORKS,
Dept. 35
2150 Lawrence Ave., Chicago, Illinois**

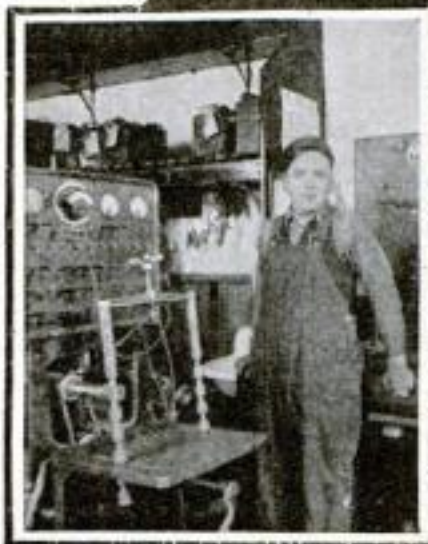
Send me at once, without obligation, your big illustrated book and complete details of your Home Study Course in Electricity, including your outfit and employment service offer.

**MAIL
COUPON FOR
FREE
BOOK OF
FACTS**

Name.....

Address.....

Occupation.....



\$9,000 a Year Auto Electricity pays W. E. Pence, Albany, Ore., over \$9,000 a year. 58 men enrolled for this training on his advice.



\$700 in 24 Days "Thanks to you, I made \$700 in 24 days in radio," says F. G. McNabb, 7 W. 16th St., Atlanta, Ga.

**5 WONDERFUL
WORKING
OUTFITS—
Given without
extra charge!**

- 1 LABORATORY AND EXPERIMENTAL OUTFIT. Complete material for interesting experiments.
- 2 BELL AND ALARM OUTFIT. Electrical apparatus, material and tools—a complete installation kit.
- 3 ELECTRIC LIGHTING OUTFIT. Switches, wire, lights, etc.—everything needed to make up all complicated electric lighting circuits.
- 4 ELECTRIC POWER OUTFIT. The Famous "Cooke" Motor and other apparatus. Not a toy—but a real, honest-to-goodness workable machine.
- 5 TRANSFORMER OUTFIT. Complete parts for building and winding this widely used equipment.

The 'Cooke' Trained Man, is the 'Big Pay' Man!



L. L. COOKE, Chief Engineer

This Big New Electrical Book FREE!

The 1925 Edition of my big book—"The Vital Facts about Electricity," is just off the press! Clip coupon NOW for your copy—it's FREE! 112 actual pictures of Electricity at work—dozens of success stories—what you can do in the Big-Pay Profession—you'll find it all in my up-to-the-minute electrical book. Send for it today!



Opportunities for Readers in Quick Action Advertising

ADDING MACHINES

FREE trial, marvelous new adding machine. Adds, subtracts, multiplies, divides automatically. Work equals \$350.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. O, Grand Rapids, Michigan.

ADVERTISING SERVICES

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

24 WORD ad 355 rural weeklies, \$14.20. Ad-Meyer, 4112P Hartford, St. Louis.

ADVERTISING in all magazines and newspapers at publisher's lowest rates. Rate Book free. Taylor's Advertising Service, Dept. 5, Freeport, Ill.

ADVERTISE—Country papers. All publications. Lowest rates. Catalog free. Owl Agency, Times Building, New York.

ADVERTISE in 24 big Sunday Newspapers. 24 words \$15.00. 300 Rural Newspapers 28 words \$10.00. 100 Big weekly newspapers 24 words \$5.00. Service 100%. Consultation Free. National Advertising Service, Richmond Hill, New York.

AUTHORS AND MANUSCRIPTS

PHOTOPLAY—Story Ideas wanted. \$25-\$500 paid. Experience unnecessary; outline Free to anyone. Write Producers League, 312, St. Louis.

SONG Poems wanted. Radio Publicity Bureau, 24 Times Square Station, New York.

SONG Poem Writers send for proposition. Ray Hibbler, D10, 4040 Dickens Av., Chicago.

I WANT song poems. Casper Nathan, J-3544 No. Racine, Chicago.

\$\$\$ FOR IDEAS. Photoplay plots considered in any form. Write today for free booklet. Universal Scenario Corporation, 214 Security Bldg., Santa Monica & Western Ave., Hollywood, Calif.

AUTOMOBILES AND ACCESSORIES

CARBON-X will keep your engine "peppy" by keeping it free from carbon. Handy package and "Why Is Carbon?" postpaid for dollar bill. Money back if you want it. Carbon-X, Box 1953, Chicago.

BEAUTIFUL ornaments motor car mascots. Write for catalogue. United Auto Supply, 1922 Westlake, Seattle, Wash.

PAINT your own Auto. Simple methods. Something New, Smooth Finish. Also Discussing Duco, \$1.00 brings instructions. C. Schroeder, West Webster, N.Y.

44 MILES on 1 gallon—Amazing, new Scientific Gas Saver. All autos. Free Demonstrator. Critchlow, T-120, Wheaton, Ill.

DELIVERY bodies for Ford Model T. Chassis with enclosed cab, suitable for Contractors, Grocers and Farmers. Three styles. Price \$42.60. Write Daniel Zimmerman, Craigville, Indiana.

AVIATION

AIRPLANES, Motors, aircraft supplies; 80 H.P. LeRhone Rotary motor \$125; 100 H.P. Gnome Rotary motor \$100; 130 H.P. Clerget Rotary Motor \$200; Lawrence 28 H.P. motor \$100; Curtiss 200 H.P. \$300; tan leather helmets \$3.75 and \$5. Wide-vision goggles \$1.75. Nonshatterable goggles—Oval \$3.25, wide-vision \$4.50; motorometer with 12 ft. tubing \$7.50; leather breeches \$12; airplane cloth 65c yd.; dope \$2.50 gal.; compass \$10; Aerial camera \$100. Logan Aviation, 716 W. Superior, Cleveland.

LEARN Aviation; Send 25c for large illustrated booklet which tells how. Varney Aircraft Co., Peoria, Ill.

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 6741, 3631 Michigan Ave., Chicago, Illinois.

BOYS get a three foot model aeroplane free. Write to Aero Shop, 3050 Huribut Ave., Detroit, Mich.

AEROPLANE Motors \$1,000.00; complete 165 Horsepower Gnome 9-cylinder engine, weight 292 pounds, air cooled. Immediate delivery \$25.00; cash with order F.O.B. Dayton. 1,100 engines purchased from Air Service. Complete planes \$500 up. Time payments. Newport model. 28 wings complete, \$6.00; good condition—bargain for plane builders. Motors ideal for ice sleds, snow sleds, motor boats, wind wagons. Write for booklet. Marvin A. Northrop, 200 Builders Exchange, Minneapolis, Minn.

MOTORS: Curtiss OXX-6 Class A (under Fifty Hours) for Plane, Sea-Sled, Motor boat, etc., \$225.00. All Motor and Plane Spares at Best Prices. Send for Catalogue. Monumental Aircraft Co., 339 N. St. Paul Terrace, Baltimore, Md.

AVIATION turnbuckles. For trussing up sagging gates and doors and many other uses. Large size, 20 cents. Medium, 25 cents. Small, 20 cents. 3 samples, 65 cents prepaid. Johnson Airplane and Supply Co., Dayton, Ohio.

BOATS AND LAUNCHES

SPEEDY boat, Ford propelled, easily built, blueprint and directions; sixty cents. Marine cooler booklet free to Ford boat owners. C. C. Hubbell, 4D East Ave., Norwalk, Conn.

BUILD your own boat:—Newly designed Speedy V-Bottom Out-Board motor, Runabouts, Cabin Cruisers, etc., 55 models KNOCK-DOWN or patterns. Send 25c for catalog. Brooks Boat Co., Inc., Salt Street, Saginaw West Side, Mich.

CONVERT your Ford Motor into dependable marine power plant. Conversion outfit including propeller \$75; reverse speed adapter \$12.50; watercooled manifold \$25. All parts for converting powerful airplane motors into marine motors; also converted and unconverted motors. Logan Aviation, 716 W. Superior, Cleveland.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

Rates 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the June, 1926 issue should be received by April 5th

BLUE PRINTS

TO the man who has a Home Workshop and likes to work with tools, Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

BUSINESS OPPORTUNITIES

BUSINESS Guide with free legal service sells everywhere. Wells cleared \$1,185 in 35 days. Write for free outfit. Nichols Co., Naperville, Ill., Dept. 1B.

USED correspondence school courses. All kinds. Sold on re-purchase basis. Big saving. Money back guarantee. Lists free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

START a factory. Employ agents and salesmen. Make big money. Our free booklet "125 Money Making Secrets" explains how you can manufacture chemical specialties, household goods, toilet articles, proprietary medicines, food products, etc. No experience required. Nelson Laboratories, Box 1217, San Francisco, Calif.

STOP plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

SUCCEED With Your Own Products—Make them yourself. Formulas, Processes, Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

RESPONSIBLE manufacturer wants competent men to manage office and salesmen. \$300 to \$1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

BUSINESS of your own. Clean rugs. Same method I use. Plan and formula \$1.00. Good for \$10.00 daily. Fink, 1050 Curtis, Toledo, Ohio.

WANT more money? Start little Mail Order Business. Samples and Plan Free. Stamp please, Snydamp, 10748—112th Street, Richmond Hill, New York.

PATENTS procured: Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

MAKE \$80 weekly; experience unnecessary; full or spare time; details free. Winner, Box 615, Philadelphia, Pa.

GOOD steady profits derived from retinning business. Our process gives best results. Rusted ice cream and milk cans must be retinned. Callender, 2529 W. 48th, Chicago.

BIG money made repairing burnt-out Radio Tubes. Instructions \$1.00. Duck Mfg. Co., Freeport, Ill.

FREE Book. Start little mail order business. Pier, 976 Cortland Street, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

SIGNS and Showcards easily painted with Letter Patterns. Large variety of styles and sizes. Sample for stamp. John Rahn, D 2120 North Neva Ave., Chicago.

LOCKSMITHING, safe work, taught by mail. C. I. Mitchell, Temple, Tex.

SUCCEED—Our twenty scientific processes put you wise. Excellent. Only 50c. Holland, Box 473, Astoria, Oregon.

MAIL Order Booklet, 2c. Where to buy goods. Harvey Teeple, Decatur, Indiana.

BE your own boss, \$100 sufficient worthy remunerative business. Dept. R, Paul Kaye, 149 Broadway, New York.

EARN \$10,000. Be financially independent with fastest selling auto devices on market. Mashken, Indiana Harbor, Ind.

I MADE \$30 a week home. French bread-making, 15 years' experience. Free booklet tells. Ashbrook, E. 67, Marengo, Ohio.

GUARANTEED profits, \$10 to \$25 weekly. I start you in a spare-time Mail Order Business furnishing everything. Write for particulars. Lea, 143 East 23rd St., New York.

MIRRORS re-silvered at home. Costs less, 5 cents per square foot; you charge 75 cents. Immense profits, plating like new, brassy worn-off auto parts, reflectors, tableware, stoves, etc. Outfits furnished. Details Free. Sprinkle, Plater, 94, Marion, Indiana.

ARE you old at forty? See our advertisement on page 141 of this issue. The Electro Thermal Company, 4057 Main Street, Steubenville, Ohio.

CAN You Add? Substantial award for correctly adding dividends of 310 companies. List free. Kerr & Co., 40 Monadnock Building, San Francisco, Calif.

BUSINESS SERVICES

CHARTERS—Delaware; best, cheapest; granted day received; free forms. Colonial Charter Co., Wilmington, Del. (99)

MAKE 'Em Pay—My system will make them pay their bills. Write for the acid test. Literature free. Burleigh L. Horr, Horr Omelia Block, Rhinelander, Wis.

BUSINESS Problems Solved—all kinds—buying, selling, financial, increasing business, advertising, getting men, getting positions, special formulas, processes etc. Long business experience, thorough research, complete files of information. Complete solution of problem \$5, particulars free. Satisfaction guaranteed. All confidential. National Information Bureau, 316J Shepard Building, Grand Rapids, Michigan.

CHALK TALKS

LAUGH producing program, \$1.00. Catalog free. Cartoonist Balda, Oshkosh, Wisconsin.

DISTRICT MANAGERS AND REPRESENTATIVES WANTED

WORLD'S fastest selling auto accessory. County distributors wanted; write to-day. G. L. W., Spring Oiler Co., San Diego, California.

DOGS

BEAUTIFUL registered bull pups cheap. Bulldogs. 501 Rockwood, Dallas, Texas.

EDUCATION AND INSTRUCTION

USED correspondence school courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d Street, New York.

"DOUBLE entry bookkeeping mastered in 60 hours with 8 keys; guaranteed; diploma." International Bookkeeping Institute, Desk 10, Springfield, Mo.

BOOKKEEPING in a week, \$2 complete. Dukes, 640 West 153d Street, New York.

FOR "Free Scholarship" (Mail Course) write Carnegie College, Rogers, Ohio.

CORRESPONDENCE Courses sold complete; 1-3 usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, 202-N. West 49th St., New York.

BECOME Patent Lawyer. Full information. Patent Law, 301 Hennepin Ave., Minneapolis, Minn.

CARTOONING and Commercial Art, 25 lessons, 300 illustrations, 2 clothbound volumes and drawing outfit \$5 postpaid. Catalog Free. Nu-Way Art School, 220 Graham Ave., Brooklyn, N. Y.

FINANCING AND INVESTMENTS

FOREIGN Bonds, stocks, drafts and currencies. All nations. Frank G. Everett Co., 35 Wall St., New York.

50,000 MARK German Government Bond, \$1.00, 10,000 Austrian Kronen 35c. Write for competition defying dealer terms. Arrow Sales, 1748 No. Park Ave., Chicago.

FORD ACCESSORIES

44 MILES on 1 Gallon—Amazing, new, scientific Gas Saver. All autos. Free Demonstrator. Critchlow, W-120, Wheaton, Ill.

ELECTRIC-EXHAUST intake manifolds, for Ford cars, write for illustrated, descriptive circular. F. M. Starbuck, Summersville, W. Va.

FORMULAS

FORMULAS—ALL KINDS. Catalog Free. Clover Laboratories, Dept. PS, Park Ridge, Illinois.

SELL battery charging solution. Formula \$1.00. Frank A. Williams, Mayfield, Calif.

FIVE A-1 Concrete Formula Guaranteed. Nationally used, covering waterproof, coloring concrete forms, sidewalks, foundations. Price \$1.00 each or five for \$3.00. Manning Cement, 309 Fifth Ave., Dept. A, New York.

100 FORMULAS, medicines, cosmetics, toilet preparations, kitchen necessities, extracts, candies, and insect powders, book of formulas, price \$1.00. Any formula you want for the workshop or home 10c each. Mary Hogan, Bokeelia, Fla. DE8C

SPECIAL Formulas for Manufacturing and Business purposes. Any one you want \$5. You must be satisfied or your money will be refunded promptly. National Information Bureau, 316H Shepard Building, Grand Rapids, Michigan.

MILLER, "Formula King." 526 Main, Norfolk, Virginia, supplies any formula.

MANUFACTURE Vitamin Foods. Big profits. Formula one dollar. F. White, Longfellow, Texas.

FOR BOYS

BOYS, Look. Movie Machines for the family sell as low as \$7.50. We carry Western and Comedy Films only. Write now for free catalogue on machines and films. Globe Supply Co., P. O. Box 2722, Dept. S, Boston, Mass.

FOR INVENTORS

INVENTOR'S Universal Educator—contains 900 mechanical movements; 50 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Price (revised edition), \$2.00 postpaid. Albert E. Dietrich, 681 Ouray Bldg., Washington, D. C.

UNPATENTED Ideas Can be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 805 Jenifer Building, Washington, D. C.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

FOR INVENTORS

MODELS Built—Inventions Developed. Well equipped Experimental shop. Service Tool Works, Inc., Indianapolis.

PATENTS: My fee in instalments. Free personal advice. Frank T. Fuller, Washington, D. C.

GET Your Own Patents. Instructions, legal blanks, \$1. Cooper Cutting, Campbell, Calif.

SELL your patented or unpatented invention. Write for my three plans. Free. Hartley, 44 Central St., Bangor, Maine.

INVENTORS: Get this pamphlet—"What to Invent". No theory or guess work, but things actually asked for by manufacturers. Sent prepaid for only \$1.00. Inventors' Syndicate, 23 Paladium Bldg., St. Louis, Mo.

INVENTORS—Preliminary investigations only to determine if your inventions are patentable. Neither preparing nor prosecuting applications for patents, I am in a position to give you honest opinions. Communications secret. R. Emmitt Patterson, Barrister Bldg., Washington, D. C.

FOR MEN AND WOMEN

DETECTIVES—Work home or travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968P Broadway, N. Y.

ARE you old at forty? See our advertisement on page 141 of this issue. The Electro Thermal Company, 4057 Main Street, Steubenville, Ohio.

FOR SALE

FOR Sale—Stone Age Relics: Axe, Pestle, Celt, Hammer, 12 flints, all \$5.00. Charles Edwards, Springport, Ind.

PURE honey, guaranteed, five pounds, \$1.25 F.O.B. Here. Soo Tin, Liberty, N. Y.

FOR THE HOME

HOT WATER ON TAP, \$6. Make your own Automatic. Write John Kirkeby, San Luis Obispo, Calif.

GRANDFATHER clock works \$5.00. Build your own case, instructions free; make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nictown, Penn.

TO the man who likes to work with tools, Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

HELP WANTED

SILVERING Mirrors, French plate. Easily learned; immense profits. Plans free. Wear Mirror Works, 31 Excelsior Springs, Mo.

MEN—Start with a startling concern. No get-rich-quick promises—As You Work So Shall You Earn. Kretan Corporation, 9629 Conant Ave., Detroit, Mich.

MR. BRUSH SALESMEN—Old established New York Brush Manufacturers require the services of men in all territories to sell their extensive line of Sanitary Twisted Wire Brushes. We pay larger commission than any other Brush House in the country. Write immediately for our proposition. Wire Grip Sanitary Brush Corporation, 15 Mercer Street, New York.

HELP WANTED INSTRUCTION

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write George Wagner, former Government Detective, 1968P Broadway, N. Y.

QUALIFY for \$150-\$300 railroad jobs. Fireman, Brakeman, Baggageman, Sleeping Car or Train Porter. 838 Railway Bureau, East St. Louis, Ill.

COMMENCE \$1900 year. Become Railway Mail Clerk. Men 18-35. Common education sufficient with our coaching. Particulars free. Write immediately. Franklin Institute, Dept. R33, Rochester, N. Y.

MEN wanting forest ranger, railway mail clerk and other government positions, write for free particulars of examinations. Mokane, Dept. B-30, Denver, Colo.

HOW TO ENTERTAIN

PLAYS, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogues, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 26, Chicago.

INCORPORATIONS

DELAWARE Incorporator, Charters: Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Delaware.

INFORMATION

CORRECT, complete information any scientific, technical, commercial, social topic concerning Brazil furnished. Consulting Engineer Freise, Petropolis, Sampaio 20. Fee 2 Dollars account Banco Hollander, Rio, Brazil.

ACCURATE, specific information on any subject \$5. National Information Bureau, 316B Shepard Building, Grand Rapids, Michigan. Prompt service, satisfaction guaranteed.

INSECTS WANTED

WHY not spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 7, Box 1424, San Diego, Cal.

INVENTIONS WANTED

WILL buy approved invention—Write—W. L. Kennedy, 416 N. Duke Street, Lancaster, Pa.

LABORATORY AND CHEMICAL SERVICES

YOUR chemical problem solved and working process furnished for \$5.00. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.



MEN WANTED FOR AUTO JOBS

E.J. Sweeney
PRESIDENT

Yes, sir, nine out of ten men, mechanically inclined, want to cash in on their training and get a good job right away. Sweeney trained men have found the right way, the easy way, to good jobs, secure employment, or of owning their own business. Sweeney Auto Training makes you independent and successful. Just the minute you graduate from the Million Dollar Sweeney School my employment department works to place you where you want to live. This department has nothing else to do but to place Sweeney trained men in fine jobs. Last month we placed graduates at from \$35.00 to \$50.00 a week in Natchez, Miss.; Springfield, Mo.; Cape Girardeau, Mo.; South Bend, Ind.; Cheyenne Wells, Colo.; Tyrone, N. Mex.; Hattiesburg, Miss.; Shipshewan, Ind.; Brookston, Ind.; Marengo, Ia.; and a large number of jobs in Kansas City, Mo., with Hudson-Brace Motor Co., Kelley Repert Motor Co., and various garages and auto agencies.

Get the Best Training

The Sweeney Auto School offers you the greatest opportunity you ever had. A big reduction in tuition—a Million Dollar Building—10 stories high—over 12 acres of floor space devoted to the "Sweeney System of Practical Instruction" under expert instructors. Just across the plaza from the Union Station, short distance from beautiful new Two Million Dollar Memorial building. Recreation after work; swimming pool, entertainment, band and orchestra, Radio Broadcasting, Sta. WHB. Remember **THERE'S ONLY ONE SWEENEY AUTO SCHOOL—ONLY ONE "SWEENEY SYSTEM"** and you can only get this system at Kansas City, Mo.

Learn a Good Trade

One that will pay you \$200 to \$500 a month and more. Get in the biggest business in the world—the Automotive Business. Make more money in 1926 than you ever dreamed possible. I want to prove that you can do what thousands of men just in your position have done as a result of "SWEENEY TRAINING." I say, take up the **AUTO BUSINESS NOW.** Learn it at **SWEENEY'S—Kansas City, Mo.**

My FREE Book Tells You—

How to run a garage anywhere.	a chauffeur or truck driver.
How to learn several good trades.	How to learn to repair any make of car.
How to travel and see the world.	How to weld.
How to fit yourself for prosperity.	How to learn batteries and auto tires.
How to get a good mechanical job.	Shows you hundreds of actual photographs of how easy it is to learn.
How to learn to be	

FREE CATALOG AND SPECIAL OFFER

Get my big FREE 64-page catalog. It shows hundreds of actual photographs of men at work in my magnificent new school. Tells all about wages, profits, opportunities in auto business. Explains step by step how you learn. Interesting letters from graduates telling how they made good. Shows how men come from all over the world to this big school. Makes you want to join the crowd. Tells everything you want to know. I will gladly send you a copy beautifully illustrated. I'll tell you how to get into business for yourself. No colored students accepted.

E. J. SWEENEY, President

LEARN A TRADE—
Sweeney
AUTOMOTIVE & ELECTRICAL SCHOOL
2509 SWEENEY BLDG., KANSAS CITY, MO.

**JOBS
PAY
\$50
a Week
and up**

COME RIGHT NOW. If you are mechanically inclined, if you like to work with tools, you will learn under the "Sweeney System," by actually doing the work, everything about all kinds of automobiles, oxy-acetylene welding, vulcanizing, battery work, electrical work, aviation, building and repairing Radio sets. No experience or education needed. No books are used. You work on most complete gas engine and electrical equipment in any school in the world. Over \$200,000 invested. \$50,000 Radio Station WHB. You'll get dirty and greasy, but you'll learn by the "Sweeney System" that fits you for big pay jobs at \$50 a week and up, waiting for Sweeney trained men.

Sweeney System of Practical Instruction

There's only one place where you can get this training—it's at the world-famous Sweeney Automotive and Electrical School of Kansas City. There's only one Sweeney School. There's only one "Sweeney System." No other school offers or can give you this training that not only trains you to fill big paying jobs but saves you time and money. This training is making big money for 70,000 Sweeney Graduates. I estimate 20,000 of them own a good paying business.



EMORY J. SWEENEY, President
2509 Sweeney Bldg., Kansas City, Mo.

Please send me your Free 64-page catalog and special offer.

Name..... Age.....

Address.....

Town..... State.....

LABORATORY AND CHEMICAL SERVICES

MELT Metals and Alloys with SPEED-HEAT Electric Furnaces, \$75.00. The Booth Electric Furnace Co., Room 1122, Monadnock Bldg., Chicago, Ill.

FORMULAS: The Best Chemical Science Can devise—Guaranteed Reliable Processes in all lines. Stamp Brings Big Bunch of Valuable Literature, Interesting Lists. Don't buy till you receive this. Chemical Analysis, Charges reasonable. Dr. Liscomb Miller, Chemist, Tampa, Florida.

EXPERIMENTERS: Complete Chemical Apparatus and Radio Catalog, 1000 Illustrations. Price 25c; refunded on \$5.00 order. Laboratory Materials Co., 641 East 71st St., Chicago.

LANGUAGES

WORLD-ROMIC System, Masterkey 5,000 languages. Primes \$1.98. Chinese, French, Spanish—Languages, 8 West 40th, New York.

LETTER SPECIALISTS

I WRITE letters, folders, booklets, complete followup for manufacturers, mail order dealers. Long experience. Write for details. L. Taylor, Box 844, Freeport, Ill.

LITERARY SPECIALISTS

FORCEFUL Literature Prepared. Reasonable Fees. Tell me your problems for free analysis. Worsek, 525a So. Dearborn St., Chicago.

ERNEST F. GARDNER, 511-B Ridge Arcade, Kansas City, Mo. Nationally known writer powerful, convincing advertisements, letters, circulars, booklets. Twenty years' experience. "Direct-Mail Advertising" booklet free.

MACHINE TOOLS

CONCRETE Building Block Machines and Molds, Catalogue free. Concrete Manufacturing Co., 5 N. Main St., St. Louis, Mo.

MAGIC TRICKS

PROHIBITION trick complete, 10c plus 2c postage. H. Rogers, Paulina St., W. Somerville, Mass.

SPIRIT Writing on Arm 25c; Chemical Slate Trick 25c; Sealed Letter Test 25c; Catalogues Free. Lonergan: Magic Company, 431 North Clark, Chicago.

BE a magician, give shows, earn money. Catalogue 20 cents. Oaks Magical Co., Dept. 550, Oshkosh, Wis.

BOOKS, Magic, Mysteries, Magic Tricks, Novelties. Catalogue Free. Singer 515, Hancock, Wisconsin.

MAIL ORDER BUSINESS

\$25,000, I MADE spare time home. Booklet for stamp. Sample and Plan 25c. Alps Scott, Cohoes, N. Y.

MAKE Money on the Side. A brand new proposition. No capital required. Splendid mail-order feature evenings. Dept. 8, Klean-A-Pipe Company, Fargo, N. Dak.

MANUFACTURING

DEVELOPING ideas and manufacturing our specialty. Absolute satisfaction, 33 years' experience; write us. The K. & B. Die & Specialty Co., 2018 Elm St., Cincinnati, Ohio, Dept. C.

MISCELLANEOUS

\$1,000 LETTER. Opportunity calls. Informative booklet free. Limited edition. PEMCO, 7 Mitchell Ave., Alton, New Hampshire.

VEHICLE control for cripples. Approved device. Makes driving safe and pleasant. Price reasonable. Simple and effective. Write Alvin Colandrea, R.F.D. No. 2, Union Ave., Somerville, N. J.

MINERAL treasure under foot. Fortunes in common minerals. List 10c. Minerals identified \$1.00. Mineral specimens. Buskett, Geologist, Joplin, Mo.

ARE you old at forty? See our advertisement on page 141 of this issue. The Electro Thermal Company, 4057 Main Street, Steubenville, Ohio.

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

HULT & CO., 625 Jackson, Chicago, Ill. Experimental Machinists. Model Makers, Dies, Patterns. Complete general Machine shop.

"SPECIAL machine builders, tool and die makers, inventor's models, production work of all kinds. Dept. J, Quality Hardware & Machine Co., Ravenswood and Thirteenth Avenues, Chicago, Ill."

WE Build Models, design, develop and manufacture articles in large or small quantities. Hohmeier Mfg. Co., 1385 E. 17th St., Cleveland, O.

MOTORCYCLES, BICYCLES, SUPPLIES

OVERSTOCKED Used Motorcycles, 1923 Indian Chief, \$95.00, 1923 Harley Davidson, \$95.00, 1923 Henderson Deluxe, \$120.00. Two hundred others, write for free list. Myerow Brothers Co., 14 Berkeley St., Boston, Mass.

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

MOTORS—ENGINES—MACHINERY

BRAND new 1 KW Westinghouse, 32 volt, 1,150 speed, light and power Generators at \$48.00 each. 25% cash, balance C.O.D. General Distributing Co., Security Storage Bldg., Duluth, Minn.

SLIGHTLY used 1/2 Horse 110 V. 3450 speed Westinghouse alternating motors \$16.00. New 1/2 Horse Westinghouse motors at less than second hand prices. 32 V. 1750 speed washing machine motors with pulleys \$7.00. Lots of eight \$6.50. Also other bargains. Queen City Electric Co., 1742 Grand Av., Chicago, Ill.

MUSICAL

PIANO JAZZ: teaches Ear Playing, Negro Harmony, Player Piano Effects, Chimes, Blues, Chords, Sweet Harmony, Particulars Write "Piano Bill," Toronto 3, Canada.

RENT a New Band Instrument. Any kind. Pay while you learn. Rental applies on purchase price. Free catalogue. VERNON GALSTER, Box H 21, Morris, Ill.

OPTICAL GOODS

ARTIFICIAL eyes. Booklet free. Denver Optic, 508 Barclay, Denver, Colorado.

OFFICE DEVICES

ADDRESSING machines, multigraph, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Pruitt, 117 N. Market St., Chicago.

OLD MONEY WANTED

\$2 TO \$500 EACH Paid for Hundreds of Old or Odd Coins. Keep all old money—it may be very valuable. Send 10 cents for Illustrated Coin Value Book, 45c. Guaranteed Prices. Get Posted. We pay cash. Clarke Coin Company, Popular Science Department, LeRoy, N. Y.

PATENT ATTORNEYS

PATENTS—Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for FREE book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 184-P Security Bank Building (directly across street from Patent Office), Washington, D. C. (See page 127)

"INVENTOR'S Adviser," the valuable Patent book with 139 mechanical movements and illustrations, sent free upon request—M. S. Labluer, Patent Attorney, 3 Park Row, New York.

PATENTS—Before disclosing an invention the inventor should write for our blank form "Record of Invention." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for Free Inspection and Instructions. Our Three Books mailed free to inventors. Our Illustrated Guide Book, "How to Obtain a Patent," contains full instructions regarding patents. Copies of unsolicited letters from manufacturers and others who are constantly writing us regarding the purchase or leasing of meritorious patents sent upon request. See advertisement on page 129. Victor J. Evans & Co., 937 Ninth, Washington, D. C.

PATENTS, trade marks, copyrights. Prompt, personal reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, Washington, D. C.

INVENTORS' Guide free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer, Woolworth Bldg., 1714, New York.

UNPATENTED Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 811 Jenner Building, Washington, D. C.

MILLIONS spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted! how we help you sell, etc. American Industries, Inc., 501 Kresge Bldg., Washington, D. C.

PATENTS, Trade-Marks, all countries. Ten years' experience examining applications in Patent Office. Consultation invited. George Beeler, Patent Attorney, 150 Nassau Street, New York.

PATENTS: My fee in installments. Free personal advice. Frank T. Fuller, Washington, D. C.

MONROE E. MILLER, Ouray Bldg., Washington, D. C., Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 232 Ouray Bldg., Washington, D. C.

PATENTS Procured: Trade Marks Registered.—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

RICHARD E. Babcock, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C. Established 1877. Booklet.

PATENTS. As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 648 F St., Wash., D. C. Estab. 1869.

PATENTS, Trade-Marks, Copyrights. Easy terms. Sanders, 2 Rand McNally Building, Chicago, Ill.

PENMANSHIP

I GUARANTEE my handwritten lessons will make you an expert penman. Full particulars and addresses of many graduates free. Send quarter for your signature twelve styles on cards. Meub, 2365 Mar Vista, Pasadena, California.

PERSONAL

YOUR Handwriting Reveals Your Character. Send 25 cents (silver) and ink sample of own or friend's writing for expert analysis and astounding demonstration of dominant characteristics. Real guide to success. R. Penkraft, Hamburg, New York.

PHOTOGRAPHY AND SUPPLIES

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 117 Camera House, Boston, 17, Massachusetts.

ESTABLISH yourself at home, as a photographic expert; make \$75 a week while learning; professional camera furnished free; write quick for full information. International Studios, Dept. 1743, 3801 Michigan Ave., Chicago.

UNEXCELLED Gloss Prints. Trial Offer. Your Kodak Film Developed and Printed only 10c. P. R. B. Photographers, Dept. "G," 1503 Lincoln Ave., Cincinnati, Ohio.

THREE 5x7 Enlargements one dollar. Prompt Service. F. Doane, Merrill Bldg., Milwaukee, Wis.

PRINTING AND ENGRAVING

EMBOSS your Stationery with Hand Embosser. Circular Free. Midwest, Box 47, Springfield, Illinois.

HIGH Grade Printing—5,000 20-lb. Hammermill Bond Letter Heads, \$13.75; 10,000, \$24.00. 6 1/4 white wave envelopes, one thousand, \$2.25. The Courier Company, Zanesville, Ohio.

BETTER Printing for Less Money. Write us about your printing needs, and you will save money. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

PRINTING, ENG. AND MULT.

BETTER Printing Business and Professional Stationery. Write us. The Arrow Press, Kankakee, Illinois.

"Bond Letterheads"—send stamp for samples. Myron Place, Harding, Mass.

RAZORS AND BLADES

TEMPORARY Offer: GRIPSIT, the Perfect Strop-ger for Gillette Blades complete with strop. Genuine Gillette Razor with blade. Complete outfit One Dollar, postpaid. Gripsit Corporation, 405 Broadway, Cambridge, Mass.

SALESMEN AND AGENTS WANTED

AGENTS—Write for free samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. Madison Co., 566 Broadway, New York.

AGENTS—Clever inventor! Inkapoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Bldg., New York.

INSTANT Weld—Repairs large punctures without cement or heat. Lenn's profit one day \$50. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

GET our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F, St. Louis, Missouri.

WASH Clothes the new way. Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3614 Enright Ave., St. Louis, Mo.

AGENTS. \$60—\$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434-A N. Clark, Chicago.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method, experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

TAKE orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 81, Chicago.

BANKRUPT and Run-down Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 600 Division, Chicago.

AGENTS—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main St., Brooklyn, N. Y.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

SELLS for \$9.75. Prints ad on wrapping paper, envelopes, etc. \$1.00 commission. Send 10c for sample work. Automatic Ad-Stamp, Joplin, Mo.

FREE Booklet describes 52 plans for making \$20.00 to \$100.00 weekly in home or office business of your own. Downs Co., 2332 Myrtle, St. Paul, Minn.

A BUSINESS of your own. Make and sell chipped glass name and house number plates, checkboards, signs. Booklet FREE. E. Palmer, Dept. 513, Wooster, Ohio.

REPLATE brass worn-off automobile parts. Reflectors. Bathroom fixtures, worn spoons, forks, etc., with pure silver. Look like new. Use U-Kan-Plate Polish. Positively no mercury. \$1.00 half pint. Postpaid. Satisfaction guaranteed. Agents wanted. U-Kan-Plate Co., Dept. B, Philadelphia.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; superseded vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

WE pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

SALESMEN—Selling Supreme Shirts means big business, big repeats! big commissions. Write today for FREE Kit. Supreme Shirt Co., 276-F Fifth Ave., New York.

WONDERFUL New Pricing System sells instantly to all stores. Big repeats! Tremendous market. Write quick. Exclusive territory. Millen, 414 Nottingham Bldg., Boston, Mass.

AGENTS—New guaranteed invention, needed homes, restaurants, etc. Big profits. 30-second demonstration sells it. Sample Free. Exclusive territory. Conaway Co., M-37, Champaign, Illinois.

NEW camera takes and finishes photos in one minute. Make money selling cameras or taking photos. Exclusive territory. Crown Co., Dept. 314, Norwalk, Conn.

BIG pay to agents selling Mother Hubbard food specialties and extensive line of other rapid repeaters. Mother Hubbard Co., 558 Congress, Chicago.

SELL guaranteed shirts, overalls, and work pants. Big variety of shirts, including silks, with a splendid line of union made work and tunnel shirts, overalls, coveralls, work pants, play suits, all guaranteed. Sell direct to wearer full or spare time. No experience required. Write today for FREE Selling Outfit. Nimrod Shirt Co., Dept. 25, 4922-24-26-28 Lincoln Ave., Chicago.

ONE CENT!! Post Card from You Brings free solid gold stud offer to Agents. Rajah Rainbow Gem Dealers experts. Rainbow Gem Co., Dept. F-10, Salisbury, N. C.

SALESMEN AND AGENTS WANTED

LIGHTNING Electrolyte. Charges storage batteries instantly. Guaranteed not to injure battery. Gallon costs 50c, sells \$10.00. Chance to clean up fortune selling to garages and agents. Make it yourself. Guaranteed formula \$5.00. Write for free circulars. Murphy, Chemist, Tujunga, Calif., Box K.

MR. BRUSH SALESMEN—Old Established New York Brush Manufacturers require the services of men in all territories to sell their extensive line of Sanitary Twisted in Wire Brushes. We pay larger commission than any other Brush House in the country. Write immediately for our proposition. Wire Grip Sanitary Brush Corporation, 15 Mercer Street, New York.

NO dull times selling food. People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. **FREE SAMPLES** to customers. Repeat orders sure; Exclusive territory. Ask now! Federal Pure Food Co., L-2311 Archer, Chicago.

SUCCEED With Your Own Products—Make them yourself. Formulas, Processes, Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

44 MILES on 1 Gallon—Amazing, new, Scientific Gas Saver. All autos. Free demonstrator. Critchlow, 8-120, Wheaton, Ill.

ICELESS Ice Cream Shipper. Amazing new invention. Eliminates ice, salt, weight and cuts express costs half. Iceless Container, St. Paul, Minn.

\$20 DAILY selling VER-I-EZY Men's shoes direct. Sell relatives, friends, neighbors first. Low priced. Give real comfort, long service. You take orders, keep big commission. We ship and collect. Full or part time. Write NOW. Easy-wear Shoe Company, Dept. 233, Indianapolis, Ind.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

AGENTS WANTED—Something new—Fyr-Fyter sells easily. Makes a spectacular demonstration; car owners, homes, factories, stores, practically buy on sight. Our men make \$10 to \$50 a day. Exclusive territory to producers. If you wish to establish a business of your own with unlimited possibilities for making big money, write us today. Fyr-Fyter Co., 999 Fyr-Fyter Bldg., Dayton, Ohio.

WE start you in business. Chemicals, formulas, processes furnished. Every home a prospect. Enormous profits. Information free. Twin City Chemical Co., 65 12th St., St. Paul, Minn.

LIGHTNING storage battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

ACTIVE men and women wanted as distributors and sales managers. Exclusive territorial rights. Pays 150 to 250 per cent profit. Darn E-Z Laboratories, Department P.S., Dayton, Ohio.

NEW wonderful seller. \$1.40 profit every \$1.50 sale; monogramming automobiles; Wilbur made \$29.50 first day. Free Samples. Worcester Monogram Co., 126, Worcester, Mass.

\$20 PROFIT daily selling needlebooks; costs 3-5c each; sells 25c; value 50c. Three samples 25c. Catalogue free. Needlebook Specialty Co., 661 Broadway, New York.

SELL BY MAIL! Big Profits! Books, Formulas, Novelties, Bargains. Particulars Free! Elfeo, 523 South Dearborn Street, Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

BRING Home the Bacon selling Stuart's famous Food Flavors. Quick sellers. Big profits. Write for free sample and terms. C. H. Stuart & Co., 6568 Main, Newark, New York.

MONEY MAKERS—200% profit selling Aut-O-Pep tablets. Guaranteed to Save Gas, Remove Carbon, Increase Power and Mileage. Results wonderful. Taylor Products Co., 22 W. Naghten, Columbus, Ohio.

SALESMAN for largest Eastern Tailoring House Superior line factory to wearer. \$29.50 up. Extra trousers free. Large commissions. Complete outfit N. E. Wholesale Tailors, Harrison Ave., Boston, Mass.

300% PROFIT. Quick Seller: Fast Repeater. Sample Free. "Bestever" Products, 1946-N, Irving Park, Chicago.

AGENTS—Stamping names on Pocket Key Protectors; sample check with your name and address, 25c. Stamping Outfits, Emblem Checks, Check Fobs, Name Plates. Hart Mfg. Co., Desk 2—305 Degraw St., Brooklyn, N. Y.

PORTRAIT men, let us tell you why our bromide prints and service are the best, prices are low now too. United Print Co., 2539 S. State, Chicago, Ill.

AGENTS wanted to mail circulars. Fast selling goods. New methods. Big profits. Particulars free. Peerless Service, Waterville, Maine.

IMPORTED 5-Color Pencil. Writes Red, Black, Blue, Green, Indelible. Sells on sight. No competition. Sample \$1.00. Aronson, K-236 W. 55th St., New York.

AGENTS—90c an hour to advertise and distribute samples to consumer. Write quick for territory and particulars. American Products Co., 5790 American Bldg., Cincinnati, Ohio.

AGENTS: 20 lines in one; \$20.00 daily; sell men, women, children, shirts, topcoats, raincoats, lingerie, hosiery, dress goods, shoes, blankets, rugs, etc. Under-sell stores. We deliver. Elaborate outfit free. Guaranteed Products Co., 509 So. Franklin, Dept. 24, Chicago.

A PAYING Position Open to representative of character. Take orders shoes-hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co. 3-412 C. St., Boston, Mass.

3 Drafting Lessons Actually FREE!

to prove you can learn at home in spare time!

We have invented a new, simplified way to teach Drafting—the first real improvement in Drafting home-instruction in history.

I will make this contract with you:

When you enroll for our home-training in Drafting, we agree to give you:

1. Complete Drafting training, by the new Practice-Method.
2. Professional Drafting Outfit, as illustrated.
3. We will help you get a good Drafting position at a substantial increase in pay.
4. Or we'll refund every cent of your money.



The American School, a million dollar No-Profit Educational Institution now offers men a double service—training for a specific job, then finding the job. For one small price, on terms of only \$5 a month, you are now assured of definite benefits, both in position and salary.

Coupon brings complete details of this sensational offer!



Job Service Free to Students and Graduates:

THE AMERICAN SCHOOL now offers its students and graduates, without cost, the services of an efficient Employment Department which keeps in touch with the employers of Draftsmen all over the United States. We have placed hundreds of men in good Drafting positions. We have made this training so complete, so practical, so easy to master, that our students are bound to make good. And, so, because the demand for real Draftsmen continues to exceed the supply and because this training actually prepares men for good Drafting positions, we back it with a Free Employment Service, free to employers, students, graduates.

Chief Drafting Engineer

American School Drexel Ave. and 58th St. Dept. D-575 Chicago, Ill.

Draftsmen WANTED!

70,000 fine jobs advertised this year, many at \$60 to \$125 a week. Get ready to fill one. Get out of the rut. Make something of yourself. Plan your future in Drafting. Even if you have only common schooling, even if you know nothing of Drafting, we guarantee to make you a real Draftsman or to refund your money! Special surprise offer right now to the first 500 men who answer this ad—reduced price, easy terms. Coupon brings complete information.

A new, rapid, simplified way

This new "Job-Method" gives you actual drafting-room jobs in a new one-step-at-a-time way. With pictures which you can understand almost without reading the "lessons." And that is why American School-trained Draftsmen can qualify for a good job at big pay when they graduate.

5 HIGHWAYS TO SUCCESS!

The big money in Drafting goes to men who specialize in Machine Design, or Electrical Drafting, or Architectural Drafting, or Structural, or Automotive. It isn't enough merely to know general Drafting practice. You must know how to calculate and design and plan original work. You need many Engineering subjects to fill the kind of a Drafting position that pays \$60 to \$125 a week. The American School now includes this specialized training in its Drafting course.

COUPON

Brings 3 Lessons Free

Get them. Test your own ability to learn Drafting and get ready for a fine job and big pay. Coupon also brings surprise offer, and complete information about your opportunities for success in Drafting. **MAIL IT TODAY!**

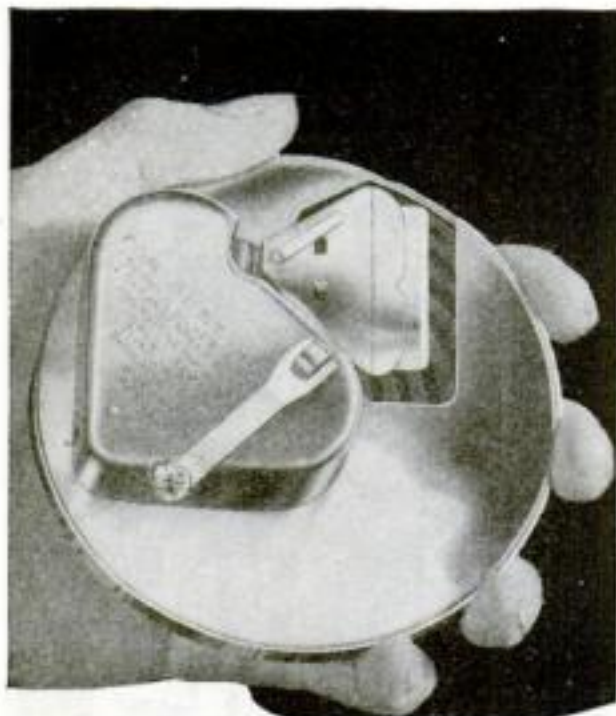
Chief Drafting Engineer
AMERICAN SCHOOL
Dept. D-575
Drexel Ave. & 58th St., Chicago

Rush 3 Free Drafting Lessons, surprise offer, complete information, money-back guarantee, etc., to prove I can become a real Draftsman at home in spare time.

Name.....

Street No.....

City.....State.....



**Use This
Amazing
Invention
and**

**I'll Guarantee
To Keep You in
Razor Blades for Life**

Sensational New Invention Guarantees You 365 Slick Shaves a Year—No More Blades to Buy!

KRISS-KROSS marks such a radical advance in shaving comfort and economy that it deserves to be called much more than a stropper. Rather it is a blade rejuvenator. Makes hundreds of keen, quick shaves blossom where only one grew before.

Kriss-Kross strops your blade on the diagonal just like a master barber. Pressure decreases automatically. Nickel jig flies up to notify you when your blade is ready, with the keenest cutting edge that steel can take!

And now for my smashing offer! For 30 days only, to introduce KRISS-KROSS stropper, I will give you an amazing new kind of razor free. Really 3 razors in one. Can be made straight or T-shape in a jiffy. Five special blades free, too.

Use these blades and keep renewing them with Kriss-Kross super-stropper. If any one goes back on you I'll recondition or replace them free! This sweeping written guarantee solves your blade problem for all time. I mean every word when I say "I'll keep you in Razor Blades for Life."

Write for Details At Once!

This astonishing offer is limited. Send for information on amazing Kriss-Kross inventions today. They are never sold in stores—and they're even more remarkable than I can tell you here. Clip the coupon today. No obligation.

AGENTS

Make big money as a Kriss-Kross representative. \$75-\$200 a week. Free gift razor is marvelous business booster. We have a unique sales plan that brings you extra profits while you sleep. K. D. Ralph made \$612 in 30 days. H. King took in \$66 one day.

Spare-time workers, office and factory men make \$5-\$10 extra a day just showing Kriss-Kross to friends. Send coupon for details. Check bottom line and mail at once!

RHODES MFG. CO. Dept. E-240
St. Louis, Mo.
Rhodes Mfg. Co.,
Dept. E-240, Pendleton & Cozens Ave.,
St. Louis, Mo.

Please send me without obligation details of your offer to keep me in Razor Blades for life. Also full description of free razor and stropper.

Name.....
Address.....
City..... State.....

SALESMEN AND AGENTS WANTED

DON'T sell for others. Employ agents yourself. Make your own products. Formulas, toilet preparations, perfumes, extracts. 500% profit. Write for our big free catalog which explains everything. National Scientific Laboratories, 1942W Broad, Richmond, Virginia.

YOUR trade uses salesboards. Make up to \$35 on single sale. Largest, lowest priced line. No samples to carry. Elaborate 3 color catalog free. Lincoln Sales Co., Dept. G, 9 So. Clinton, Chicago.

DISTRIBUTORS wanted for Mystifying Radio Gas Lighters and Masterlite Cigar Lighters. Everybody interested. Sell to consumers, dealers. Big profits, steady business. Selling Plans free. L. Masterlite Co., 110 E. 23rd St., New York.

MAKE Money, silvering mirrors, refinishing auto headlights, tableware; metal plating, bedsteads, chandeliers. Outfits furnished. International Laboratories, Dept. 64, 309 Fifth Ave., New York.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

EARN \$10 daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Decle Laboratories, 1133 Broadway, New York.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

MAGIC Polishing Cloth—Great seller. Big Profit. Free sample to workers. Get this proposition. Newton Co., 107 Main St., Newark, New York.

BIG MONEY, fast sales; every owner buys gold initials for his auto. You charge \$1.50, make \$1.44. Ten orders daily easy. Samples free. World Monogram, Dept. 25, Newark, N. J.

TAILORING salesmen. Largest line made to order union label suits, overcoats. Special! Suit or overcoat \$24.50. Extra trousers free! Commissions \$4-\$8 every sale. Big sales outfit free. Scott System QW Washington St., Boston, Mass.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

SELLING Like Blazes. Eleven piece toilet goods assortment at \$2.00 with two piece carrying set FREE to your customers, 100% profit. Davis Products Co., Dept. 57, 1321 Carroll, Chicago, Ill.

OVER 100% Profit, Self-Lighting Gas and Cigar Lighters. Everybody interested; repeat business. Sell individuals, dealers, subagents. Particulars FREE. S. M. Bernhardt, 127 West 30th St., New York.

"AGENTS" and Mail Dealers' Guide and large imprint catalogue free. Pruitt Pub. Co., Station E-8, Kansas City, Mo.

MARVELOUS invention! Does away with phonograph needles. Preserves records. Saves \$25 in needles. Pays \$90 weekly. Sample on approval if requested. Everplay, Desk G-5, McClurg Bldg., Chicago.

NEWEST invention! Sells everywhere. Automatically prevents telephone and iron cords from tangling and kinking. \$90 weekly. Samples for test if desired. Neverknot, Dept. J-5, McClurg Bldg., Chicago.

IF YOU think in Terms of \$6,000 the First Year write Us Now. Strong line for retail stores. Nationally advertised. Established concern. Best season now starting. Liberal weekly advance to producer. The Continental Co., 1317 Liberty Bldg., Cleveland, Ohio.

AGENTS—Send for sworn proof of \$5 to \$15 daily, introducing New Style Guaranteed Hosiery. 57 styles, 40 colors. No capital or experience required. Just write orders. We deliver and collect. **YOUR PAY DAILY**, also monthly bonus. Free auto offer besides. We supply samples. All colors, grades including silks. Macoshee Textile Company, Card 1525, Cincinnati, Ohio.

SALES Agents—Take orders High Grade Tailored Neckwear. Guaranteed for 6 months. Insured never to roll, twist, stretch or bunch. Not sold in stores. Write for beautiful line samples. Better-Made Cravat Co., Wholesale Dept. 7, Columbus, Ohio.

AGENTS make \$57 a day driving nails in tires! Amazing discovery heals all punctures—one tire was punctured 357 times without a leak. Send for Free Sample Offer. O. S. Nelson, E-3026 Logan Bldg., Mitchell, S. Dak.

CAN you sell Ford size tires at \$3.50 each? Write for plan. Details free. American Accessories Co., Dept. 179, Cincinnati, Ohio.

OH HELLO. Why didn't I see this before. Christy's Iron Rust and Stain Remover sells like blazes. Write for free sample and terms. A. N. Christy & Co., 5068 Union, Newark, New York.

SELL Greeting Cards, 35% Commission. Information free. Wolfprint, Lawndale, Philadelphia.

WE want men and women as local representatives to sell our nationally known Nustile hosiery and lingerie. Full or spare time. Experience unnecessary. Earnings large. Write for details. The Nustile Company, Dept. 4-4, Philadelphia.

FORMULAS for making your own guaranteed products. Investment Small. No Machinery Needed. 300 to 1200% profit! Stamp Brings Interesting Descriptive Literature for Fly Killing Spray, Delicious Summer Drinks, Best Metal Polishing Cloth, Hair Marcell Liquid, No-Water Hand Soap, Lightning Battery Charging Liquid, Mendit, Fabric Patching Liquid; Amazon Tire Repair, Washing Compounds; Compilth Woodstone, Wonder Gloss; Wizard Polish; Pure Food; Toilet, Medical, Household Specialties. All lines. State what interests most. Miller, Chemist, 1706 Jettony, Tampa, Florida.

AGENTS, \$14.85 daily in advance. Bonus besides. Send for sworn proof. Introduce finest line guaranteed hosiery you ever saw. Beats store prices. 126 styles, colors. New selling plan. We deliver or you deliver, suit yourself. Auto furnished. No experience needed. Spare time satisfactory. Credit given. Samples furnished. Wilkint Hosiery Co., Dept. 232, Greenfield, Ohio.

AGENTS, both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now, Connolly, 123 Liberty St., New York.

SALESMEN AND AGENTS WANTED

MIRRORS re-silvered at home. Costs less than 5c per square foot; you charge 75c. Immense profits, plating like new, brassy worn-off auto parts, reflectors, tableware, stoves, etc. Outfits furnished. Details FREE. Sprinkle, Plater, 96, Marion, Indiana.

SALESMEN—Sell new "Flash" Fire Extinguishers. Men wanted everywhere. Make \$600.00 per month. Improved extinguisher operates like flashlight. Retail \$7.50 to \$12.00. Large commissions. Developed by United States Government Air Service. Stock equipment now on Government airplanes. Be first in field with this new invention. Full or part time. No experience necessary. Write quick. Automatic Fire Extinguisher Co., Desk A-5, 219 S. Ludlow, Dayton, Ohio.

AUTO Accessory Distributor-Salesman Radiator Cement. \$2.40 dozen. John Letendre, New Bedford, Mass.

AGENTS coining money selling "LANOWA" Products. Greatest utilities known. Big demand everywhere. Write quick for sample. Fraser Products, 305-E. 43rd, Kansas City, Mo.

IT'S the season's biggest selling hit. Every car owner and garage will buy auto Mitten Dusters. 200% profit. Sample given. National Fibre Broom Co., St. Louis, Mo.

AGENTS, I'll pay you \$240 month taking orders for New Guaranteed Hosiery. Biggest, best, most beautiful line offered. Pay you daily in advance. Extra bonus besides. New plan puts you above competition. No experience needed. Credit given. Samples furnished. Write for amazing offer. Jennings Hosiery Co., Dept. 632, Dayton, Ohio.

IF I SEND YOU Shoes made-to-your measure in any one of 69 leathers, 50 different styles, will you keep them, wear them, show them to your friends as sample of my \$10 Made-to-Order shoes to sell at \$6.85? Advise me today. Your sample outfit will go forward absolutely free at once. Dept. 9025, Forrest Dustin, 932 Wrightwood Ave., Chicago.

STARTLING Selling Plant! \$1.25 premium free to every customer on \$2.00 sale of 8 ounce Vanilla, 6 ounce Shampoo and 4 ounce Lemon Lotion. Details and samples free. C. I. Togstad, Dept. 10G, 29 South Clinton, Chicago, Illinois.

SELL fine made-to-order all wool suits at \$31.50. Regular \$55 values. Over 100 6x9 cloth samples, all one price. Furnished. Hustlers earn \$100 weekly. Write W. Z. Gibson, Inc., 161 W. Harrison St., Dept. S-626, Chicago, Ill.

POLMET POLISHING CLOTH cleans all metal. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

SALESMAN for largest New England House. Suits, topcoats \$23.50 factory to wearer. Largest commissions. Possibilities \$5000 up. Boston Wholesale Clothing, 47 Beach, Boston.

\$95.00 A WEEK for agents! Take orders for charming Val-Style hats, sold direct. No competition. Latest Paris models, guaranteed. Low prices. Big commissions daily. Selling equipment FREE. Val-Style Hat Co., Desk 55, Cincinnati, O.

AGENTS work at home. Spare time. Nominal investment. Large profits. Interstate Commercial Service, Elizabeth, N. J.

\$20.00 A DAY selling Felt Rugs. C. P. Dotson, Mt. Vernon, Ohio.

STAMMERING

ST-TUT-T-T-TERING and stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Arcade, 1126 Granville Avenue, Chicago, Ill.

STAMPS AND COINS

1000 DIFFERENT stamps only 75c; from Armenia, Iceland, Zanzibar, etc., to approval applicants only. Bargain lists free. Victoria Stamp Co., London, Canada.

CALIFORNIA gold 8 1/4 size, 2 c.; 8 1/2 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

OLD Coins. Large Spring Selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101B Tremont Street, Boston, Mass.

1,000 MIXED U. S. and Foreign Stamps 25c. Phil Lundstedt, Cape Cottage, Maine.

STAMPS Free—Ask for money-saving approvals. John K. Borresen, Cedar Falls, Iowa.

FOREIGN Stamp collection sent free. Cornish Company, Schenectady, N. Y.

OLD Coins and Stamps wanted. Buying list free. Stamp & Coin Collector, tells about stamps and coins. 6 months 25c. Kraus, 409 Chestnut, Milwaukee, Wis.

GUARANTEED! The greatest bargains ever offered collectors in largest illustrated price list ever issued, 4c. Penna. Stamp Co., Manor, Pa.

HINGES, 1000 perfect pebble hinges 5c only to real applicants for approval sheets. Confederate \$1 Bill with above if you pay postage. Tell your friends. R. Pettet, 690 S. Boulevard, Atlanta, Ga.

109 DIFFERENT including set "War Prisoners," Bulgaria and Turkey Picture Stamps, 10 cents. Sonnee Stamp Company, 675 Ivy, Ft. Paul, Minn.

ZANZIBAR, Abyssinia, Travancore, Herzegovina, Mozambique, Quelimane stamps, menagerie collection, album, 10c. Liberty, 3974 Arsenal, St. Louis, Mo.

50 DIFFERENT stamps free to approval applicants. Rubin Huffman, 405 Pennsylvania Ave., Brooklyn, N. Y.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS: all makes; lowest prices; 5 year guarantee; send for illustrated catalogue. Henry Typewriter Co., 217 West 125 Street, New York, N. Y.

TYPEWRITERS. All Models, used and rebuilt, at lowest prices. Send for price list before buying elsewhere. We save you money. Keith's Supply House, Long Branch, N. J.

WANTED

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write, George Wagner, former Government Detective, 1908P Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

Remodeling an Old House

(Continued from page 30)

wall is a more difficult and arduous task.

Most floors that have been subject to wear for twenty or more years usually need renewal. They are probably of single thickness. The wide oak boards of the antique house show knotty high points, cracks and warping. Later floors are open-jointed and splintery. Whatever it be, the old surface may be left for a subfloor. After nailing down loose board edges and removing excessive irregularities, cover with one or two layers of building paper, and apply new flooring, preferably quartersawn stock in narrow widths of oak, maple or yellow pine. Then you will have a substantial, warm and creakless floor that will last many years.

OUR ancestors built their ceilings low because with the inadequate heating system of log fires they had to conserve warmth. To increase the height of first floor ceilings, we may raise the house above its foundations and lower the floor. If the foundations are high, the floor may be let down without jacking up the building, and the cellar can be deepened to make up for the loss. The floor joists that are lowered may be attached to the walls with metal hangers or they can rest on a masonry edge added to the foundations. With this method there may be some exposure of foundation walls within the living quarters, but these may be covered with trim and regarded as a baseboard, or enough material may be added to the upper part of the interior wall to equalize the difference. On the outside, the exterior house covering may be extended to cover the section of foundation used as upper wall.

IF the ceilings of both first and second floors are to be lifted, perhaps enough space can be taken from the attic; which, of course, will give angled ceilings to the second floor. Another method is to raise or extend the roof upward. The illustration at the top of page 29 shows how a new roof can be built over an old one while the family continues to live in the house. It is a novel scheme, original with the owner, W. Williams, and seems to be a good one, for besides affording shelter to the occupants it protects the interior during the remodeling period. In a dry season or climate, the job could be done more quickly and economically by demolishing the old roof first.

Sometimes a spacious ceiling for a living room is obtained by sacrificing the part of the second floor immediately above. Almost any height can be realized in this manner. While a very high ceiling always looks well and affords airy coolness in summer, it may not be a good thing in winter from the heating standpoint. I know of a case where the living room reaches the total interior height of the dwelling. It is handsome enough, but almost unusable in winter.

More windows or larger ones are needed by houses according to their antiquity. For this job, we should first obtain the new window frames and figure the space they will occupy (Continued on page 126)

FASCINATING



..... and perhaps you, like other ambitious men, due to the lack of money, time and education necessary to master difficult mechanical trades, wonder what you can get into *quickly* and make the most out of, *now!* Haven't you overlooked the very thing you are looking for? For there is a profession begging for clean-cut, earnest men, like yourself! Look into it. 60,000 Moler graduates *know* Modern Barbering is easy to learn, inexpensive, *quicker* to earn, *clean* and **FASCINATING!** It pays *better* than you think! **FIND OUT!** Write for booklet C5.

Address the branch of the **MOLER SYSTEM OF COLLEGES** nearest you
(Street address not needed)

Chicago, Ill.	Detroit, Mich.	Memphis, Tenn.	Los Angeles, Calif.
New York, N. Y.	Denver, Colo.	Dallas, Tex.	Salt Lake City, Utah
St. Louis, Mo.	New Orleans, La.	Houston, Tex.	San Francisco, Calif.
Kansas City, Mo.	Omaha, Nebr.	San Antonio, Tex.	Tacoma, Wash.
Cincinnati, Ohio	Milwaukee, Wis.	Minneapolis, Minn.	Portland, Ore.
Cleveland, Ohio	Atlanta, Ga.	Seattle, Wash.	Winnipeg, Man., Can.
Fargo, N. D.			Toronto, Ont., Can.

\$100 in Cash Prizes

See Page 4 in front of book for details



Want \$158-\$225 a Month?

**Railway
MAIL CLERKS**

**Your Chance Is Here
Mail Coupon Before You Lose It**

Steady Work—No Layoffs—Paid Vacations
Travel—See Your Country
Common Education Sufficient
Many other positions for men—boys 18 up

Franklin Institute, Dept. P272, Rochester, N. Y.
Sirs: Rush to me without charge, (1) sample Railway Postal Clerk Examination questions; (2) tell me how to get a U. S. Government job; (3) send list of places at which examinations will be held.

Name.....
Address.....

INVENTORS PROTECT YOUR IDEAS

Before disclosing your invention send for our Evidence of Invention Blank. This should be signed and witnessed and returned to us with a model or sketch and a description of your invention for our *Inspection and Instructions* which are free.

Also send for

Our guide book "How to Get Your Patent" which is sent free upon request. This book includes full instructions regarding U. S. Patents, Trade Marks, our Terms, Methods, etc.

WRITE TODAY

RANDOLPH & COMPANY,
Washington, D. C. Dept. 130.

Please send me FREE OF CHARGE your Evidence of Invention blank and your guide "How to Get Your Patent."

Name.....

Street.....

City..... State.....

Terms
Reasonable
Best
References

RANDOLPH & CO.
Dept. 130, Washington, D. C.



Electricity at your finger ends

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books at a pocket size; flexible covers. Order a set to-day to look over.

HAWKINS GUIDES

3500 PAGES \$1 A VOLUME
4700 PICTURES \$1 A MONTH

These books tell you all about —

Magnetism — Induction — Experiments — Dynamos — Electric Machinery — Motors — Armatures — Armature Windings — Installing of Dynamos — Electrical Instrument Testing — Practical Management of Dynamos and Motors — Distribution Systems — Wiring — Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters — Rectifiers — Alternating Current Systems — Circuit Breakers — Measuring Instruments — Switch Boards — Wiring — Power Stations — Installing — Telephone — Telegraph — Wireless — Bells — Lighting — Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index.

SHIPPED TO YOU FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth \$100 to you—pay \$1.00 a month for ten months or return it.

SEND NO MONEY THEO. AUDEL & CO.
65 W. 23rd St., N. Y.

Please submit for examination Hawkins Electrical Guides (Price \$1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I will agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Name.....
Address.....
Occupation.....
Employed by..... 5734

\$2.50 an Hour Easy

YOUR PROFITS IN ADVANCE

STAY - PREST TROUSER PRESSER sells quick—everywhere. Thousands in use. Salesmen and saleswomen cleaning up. Sells on eight-minute demonstration. Reasonable price. 40% clear profit for you. You take orders. We deliver.

Wonderful New Invention

Puts perfect crease in trousers. Takes out wrinkles and baggy knees. Easy to use—takes less than a minute. Folds into small size. Finely finished. Looks rich. Saves clothes and tailor bills. Every man wants one or two.

Make Big Profits — Others Do
Jack Ames made \$24.00 in four hours. Handle sold twenty-five the first day. Mary Roberts made \$10.00 in one evening. Others making good in full or spare time. So can you.

FREE Write us quick for free sample order and full details.

The Getgey-Jung Co., Dept. E-143 G.&J. Bldg. Cincinnati, O.

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN

Patent Lawyer

6 Owen Building, Washington, D. C.
41-D, Park Row New York City

TRADE-MARKS
REGISTERED

Remodeling an Old House

(Continued from page 125)

plus doubled two by fours on every side. Of course at least one of the wall studs already in place will represent part of the frame support. Mark the indicated area on the wall and saw out the material. A neighbor of mine used this method successfully. When he came to nails he used a hacksaw. This operation naturally applies to wooden construction. Putting new windows in a stone or brick house verges on engineering.

TO make a few good-sized rooms out of several cubby-holes presents no difficulty unless partitions which support structural weight must be shifted.

A good many persons with enthusiasm and more or less skill with tools do their own house revamping. Often they accomplish it in spare time from regular jobs, using nights as well as holidays. By thus being your own contractor and carpenter, you can save a few hundred and perhaps even a few thousand dollars.

Helium May Not Be Inert

THE formation of an apparently stable combination of helium and mercury was recently announced by J. J. Manley, chemist, of Oxford, England. According to his statement, the combination brought about electric discharges, and, considered a helid of mercury, is perfectly stable under normal conditions and is easily absorbed by charcoal at a temperature of -310° F. The combination is split up into its components at a comparatively high temperature.

This announcement completely upsets the prevailing theory of atomic structure. Helium, argon, krypton, xenon and neon form a group of elements known in chemistry as "noble" or inert gases, because they combine neither with one another nor with any other known element. This disinclination to combine was accounted for by their atomic structure in accordance with the generally accepted atomic theory.

If further research should verify these statements, it would prove that helium is not an inert gas and would throw into confusion many important fundamentals of the present atomic theory.

What Our Readers Say

A splendid magazine. Keep up the good work! More power to you!—G. C. S., Allentown, Pa.

I take pleasure in returning check sent me for the Picture Contest. Please enter my subscription to your important magazine, which I enjoy very much. I would rather stop eating (if I had to save money that way to pay for it) than be without it!—A. H., Santiago, Chile, South America.

POPULAR SCIENCE MONTHLY is appreciated by the employees here on my ranch more than any other publication that comes here.—J. H. C., Agate, Neb.

As a reader of your magazine, I wish to congratulate you upon the article, "Just What Tools Do You Need?" in the March issue. In my own estimation, a magazine which contains anything on tools contains something worth-while.—K. McK., Alba, Tex.

MY PATENT
LAW OFFICESJUST ACROSS
STREET FROM
U.S. PAT. OFF.

At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.

PATENTS

INVENTORS
Write for these
FREE BOOKS!

PROTECT YOUR IDEAS

Take the First Step Today—ACTION COUNTS

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

No Charge for Information on How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims

Practice confined exclusively to Patents, Trademarks, and Copyrights



CLARENCE A. O'BRIEN
REGISTERED PATENT ATTORNEY
WASHINGTON, D. C.

RECORD
— OF —
INVENTION
BLANK

TO WHOM IT
MAY CONCERN



Strict Secrecy Pre- served—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

Mail this Coupon NOW.

CLARENCE A. O'BRIEN

Registered Patent Attorney,

8897 Security Savings & Commercial Bank Bldg.,
Washington, D. C.

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name

Address

(Important: Print or Write name clearly).

PATENTS

TRADE-MARKS
DESIGNS
FOREIGN PATENTS

MUNN & CO. PATENT ATTORNEYS

Associated since 1846 with the Scientific American

683 WOOLWORTH BUILDING
New York City

522 SCIENTIFIC AMERICAN BLDG.
Washington, D. C.

1311 TOWER BUILDING
Chicago, Ill.

664 HOBART BUILDING
San Francisco, Cal.

519 VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents
and Trade Marks By Request.
Associates in All Foreign Countries.

INVENTIONS
Commercialized
ON A CASH OR ROYALTY BASIS
PATENTED or UNPATENTED
In Business 25 Years - Complete Facilities - References.
Write **ADAM FISHER MFG. CO.**
183-D Enright Ave. St. Louis, Mo.

INVENTORS who derive large profits know and heed certain simple but vital facts before applying for Patents. Our book *Patent-Sense* gives those facts; sent free. Write **LACEY & LACEY**, 648 F St., Washington, D. C. Established 1869.

"\$200 a Week in this Outdoor Occupation"

Men—Women—get out of stuffy offices, stores and fume-filled factories.

I did, and I now earn \$200 a week as a Real Estate Specialist. If you want to learn the secret of my success and use my amazingly resultful system, mail coupon at once for a free copy of a new book "How to Become a Real Estate Specialist."

It shows you how to get started right at home—in your spare time—without capital or experience; how you can build up a profitable, independent business of your own, and make more money than you ever before thought possible.

Director, American Business Builders, Inc.
Dept. 34-E 18 E. 18th St., N. Y.

Director, American Business Builders, Inc.
(Authorized Capital \$500,000.00)
Dept. 34-E, 18 East 18th Street, New York

Send me a free copy of your new book
"How to Become a Real Estate Specialist."

Name _____
Address _____



Proof!

"Have earned \$4,000 in 9 months." — W. A. Robinson, Illinois.
"Made \$900 in three months in my spare time." — M. L. Stokes, Pennsylvania.
"Enabled me to sell many thousand dollars worth of Real Estate." — Carrie Marshall, Miss.
"Made \$1,200 already." — E. K. McLendon, Oregon.
"Have made \$15,400 with your system." — H. G. Stewart, Florida.
"Made \$4,500 in one deal." — L. C. Clarke, N. Y.
"Made net profits of \$2,200 in one month." — E. M. Coffey, N. J.
"Increased my earnings 200%." — A. J. Bennett, Michigan.

**FREE
BOOK**

PATENTS

BOOKLET FREE HIGHEST REFERENCES
PROMPTNESS ASSURED BEST RESULTS

Send drawing or model for examination
and report as to patentability

WATSON E. COLEMAN, Patent Lawyer
644 G Street N. W., Washington, D. C.

PATENTS

Trade-marks, Copyrights, Patent Litigation,
Handbook with illustrations, 100 mechanical
movements. Sent free on request.

ALBERT E. DIETERICH

Formerly member Examining Corp. U. S. Patent Office
Patent Lawyer and solicitor
27 years' experience

681-A Ouray Bldg. Washington, D. C.

U.S. PATENTS



DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.

PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
Registered Patent Attorneys In U. S. and Canada

274 Ouray Bldg.
WASHINGTON, D. C.

Originators of forms "Evidence of Conception."

Americans Plan World's Largest Airship

(Continued from page 35)

exactly," said Dr. Arnstein, "that a ship of this size can be designed to meet any conditions. In planning the GZ-1, we have taken into account every possible contingency.

"Even suppose we count on the dashing of the ship against a mountain, we know that the only injury would be a slight bending of the girders. The helium cells within could not be damaged. And even if that were possible, we know that such a ship would operate efficiently with two cells empty."

Dr. Arnstein told me that the GZ-1 will carry easily 100 passengers in addition to a dozen tons of freight and baggage and from three to six tons of mail. It will be fitted out like the finest ocean liners, with passenger cabins, staterooms, bathrooms including showers, and dining rooms. It will have promenades running the length of the ship on both sides, with windows from which passengers may view the world below.

FROM his description I could picture this Leviathan-of-the-air at a not far distant time sailing high over the sea as a commercial ship, speeding past the swiftest of ocean liners below, carrying passengers in luxury from New York to London in two days, and making the round trip to Europe and back in a week or ten days.

I could visualize this same gigantic air liner on a world cruise, picking up fuel and supplies from a mother ship in the Philippines, or tying up to a mooring mast somewhere in Europe.

And when I left America's Zeppelin plant, with its busy group of skilled and determined men, it was with a feeling of renewed confidence in the future of ships that are lighter than air. Perhaps it is much the same feeling that is back of the discussion in Congress of an appropriation for two 6,000,000-cubic-foot dreadnaughts of the air to replace the *Shenandoah*, or that has induced a Detroit aircraft concern to plan an all-metal airship more than twice the size of the *Shenandoah*, to be fireproof and weatherproof.

FROM the navy plans of the huge aerial dreadnaughts, we can picture them bristling with guns to repel attacks of airplanes. According to the description given by Rear-Admiral Moffett, navy air chief, each would be armed with twenty-five machine guns and with 9700 rounds of ammunition. They would have no armor, but would rely on the non-inflammability of helium gas for protection from bullets fired from the ground and from airplanes.

Their machine guns would be so situated, says the Admiral, that an enemy aircraft could not approach from any direction or angle without receiving a concentrated fire.

"In this air vessel," he adds, "five hundred men, each with forty-five pounds of equipment, could be carried from San Francisco to Hawaii in thirty hours and arrive after that journey with a twenty-four-hour reserve of fuel."

PATENTS TRADE-MARKS AND COPYRIGHTS

OUR OFFER:

Your first step

Before disclosing an invention the inventor should write for our blank form "RECORD OF INVENTION." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS.

NO CHARGE FOR THE ABOVE INFORMATION

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding Trade-Marks and unfair competition in trade.

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL
INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED

IMPORTANT

TO MAKE YOUR CASE SPECIAL AND AVOID DELAY YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and obtain early filing date in Patent Office. To secure special preparation of your case send \$25.00 on account with model or sketch and description of your invention.



Private Office, Victor J. Evans, with view of Patent Office Through Window

Highest References Prompt Attention Reasonable Terms
VICTOR J. EVANS & CO., Patent Attorneys

**FREE
COUPON**

Main Offices: 760-9th St., N. W., Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name

Address



New York Office
Suite 1007 Woolworth Bldg.



Philadelphia, Pa., Office
Suite 518-519 Liberty Bldg.



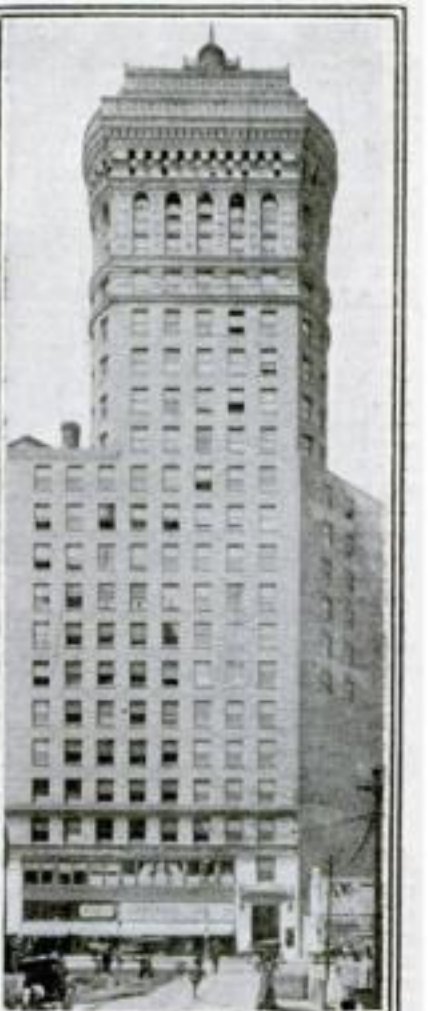
Washington, D. C., Office
Victor Bldg.



Chicago, Ill., Office
Suite 1114 Tacoma Bldg.



Pittsburgh, Pa., Office
Suite 514 Empire Bldg.



San Francisco, Cal., Office
Suite 1010 Hobart Bldg.

LEARN to FLY



You Fly by Flying!

SWEENEY SYSTEM

of Practical Airplane Mechanics

opens up a world of opportunities for young men. The Sweeney System has no planes to sell, and sticks strictly to teaching both ground work and pilotage. Sweeney Airport approved by U. S. Air Mail Service as one of the best and safest fields in the U. S. All the resources of this Million Dollar School insure you the best, most practical instruction. Mechanics earn \$50 to \$150 a week. Flyers up to \$500.

THE SWEENEY SYSTEM

first prepares a student by intensive practical work on motors, building, recovering wings, rigging and all details of construction, repairing and handling. This is called ground school work. Instructor Spencer, an overseas flyer, tells you that it took about 4000 mechanics and assistants to keep several hundred flyers in the air at his field in France. To show you the quality of the men who teach you look at Spencer and Wimer for instance. Spencer was an army pilot and has been teaching and doing commercial flying since 1917. Wimer is a college man, went overseas, was with the 1st Air Park, was an observer, spent over 200 hours in the air and since the war has been with two big aircraft corporations.



THE SWEENEY SYSTEM

is divided into two parts. FIRST: You are thoroughly taught in the ground school. This fits you as an aviation mechanic. You can build your own plane and do anything re-

quired in aviation mechanics and construction and repairing when you have finished this work. You are thoroughly taught motors, etc., and work with thousands of dollars worth of new material, including all types of engines. Liberty's, Sturdevants, Gnomes, Hall Scott fours and sixes, etc.

SECONDLY: after completing this work if you want to be a pilot you take ten hours of flying. Now when you understand that two to seven hours is all the average man needs to learn expert flying you will appreciate what ten hours in the air under skilled men will do for you.

LEARN TO FLY! Aviation is no longer a mystery—no longer a hazard; no, it is a business growing greater and more important; you can qualify as a mechanic, or an engineer, or repair man, or builder; five men on the ground are needed for one man in the air, but if you want to become a pilot you easily master the work and can go into postal, government, or commercial work. Flyers are in demand, earning big money at fairs taking up passengers, etc. \$5 for a 10-minute flight is pretty fine pay!

SEND NAME TODAY for full details of this aviation mechanical course and photographs of planes and equipment actually used; also full information as to the commercial end of flying and opportunities for young men.

LEARN TO FLY BY FLYING
Sweeney
SCHOOL OF AVIATION
2508 SWEENEY BLDG., KANSAS CITY, MO.

SEND THIS NOW

EMORY J. SWEENEY, President
2508 Sweeney Bldg., KANSAS CITY, MO.

Please send me full information about your Aviation Course.

Name.....Age.....

Address.....

Town.....State.....

A Game of Uncertainties

(Continued from page 21)

excludes the sport from the list of exact sciences, it is significant that one breeder, John E. Madden, a close student of heredity, produces at his breeding farm, Hamburg Place, Ky., the greatest list of money-winners with amazing regularity, year after year.

Still no man, not even Madden, can be certain when he has a champion on his hands; no man can be certain that his champion of today will be a champion a week hence. And so it is that race horses receive care such as a loving mother lavishes on her first-born. The delicate racing thoroughbred requires coddling, petting, and absolute regularity in feeding, exercise and grooming.

ACCORDINGLY, the typical racing stable is a large, complex and expensive establishment. There is in charge the trainer. He may be an employee or he may be the owner of the horses in his charge. Depending upon the size of his "string," the trainer will have assistants—foremen, stable hands, exercise boys, a cook, for each big stable feeds its personnel, and, of course, jockeys.

The day for horses and their attendants begins with dawn. In charge of exercise boys, the horses are taken to the track. This horse requires a long conditioning gallop; that one a brisk workout of a half mile; another a swift run of a longer distance. Scarcely any two horses are alike in their training requirements. Some will do their best only for certain exercise boys. Some are sluggish, others lively; some mean-tempered, others staid and gentle. It is up to the trainer to know the peculiarities of his various charges and to conduct their training accordingly. And that training starts long before they get to the race track—when they leave the sales ring.

FROM the ring the young horses go to pasture, where they romp about until the fall. Then their education begins; a process difficult and tedious for their trainers, for these young animals are delicate, sensitive and highstrung, and easily can be harmed irreparably. It is often a real job, for example, to teach them to remain alone in a box stall. They are frightened by their new environment, and frequently refuse to eat. Gradually, though, they become accustomed to their change of circumstances. Then is begun the "breaking" process.

The first step is to accustom them to bit and bridle. After this, an exercise boy mounts them bareback. A couple of muscular stable hands act as assistants in this lesson, for these young aristocrats of horsedom can put up an exhibition of kicking and bucking that would do credit to a rodeo. Eventually, though, the youngsters are walking peacefully about.

Then they are saddled for the first time. There are further objections from the young horses, but again the patience and kindness of the trainer prevail. Walking exercise is the next step, usually in the company of an older, placid horse whose example has a steadying effect.

When the colt or filly can walk to the satisfaction of its (Continued on page 131)

Four Vital Subjects

The Lord
The Holy Scripture
Life - Faith

by EMANUEL SWEDENBORG

Book of 634 pages, clear print, good paper, substantially bound in stiff paper covers. Endowment enables us to send this book to any address without further cost or obligation on receipt of only

Five Cents

The American Swedenborg Printing and Publishing Society

Room 313, 16 E. 41st St., New York

Salesmen Wanted

Several live-wire salesmen wanted in every state to sell Carter Oil Gauges to Ford owners, dealers, accessory stores, garages, etc. Our unique sales plan makes it easy for hundreds of salesmen to get

\$50 OR MORE WEEKLY

Full or spare time—repeat orders with liberal commissions mean permanent, big-paying business. 100,000 Carter Gauges already sold—every Ford car should have one—simple—dependable—quickly attached—fully guaranteed—Big sales campaign just starting—Write or wire for full details.

CARTER GAUGE CO.

612 Webb Street

Dayton, Ohio

Easy Way to Make Money at Home

You can! Scores make over \$25 a week in spare time—\$50 to \$100 a week in full time. Every active local store welcomes clever sales-producing Display Cards. Easy to learn at home through new professional course. Earn while you learn. Write for Free Illustrated Booklet NOW.

WASHINGTON SHOW CARD SCHOOL, Room 245-D, 1115-15th St., N. W., Washington, D. C.

Tire Agents Wanted
Use and introduce MELLINGER CORD TIRES
15,000 MILES GUARANTEED
Lowest Wholesale Prices in America. Shipped prepaid on approval. Make big money all or part time. No capital or experience. Sample sections furnished.
YOUR TIRES GIVEN!
Simply send name today for FREE BOOK, tells how thousands do big business. Special Agents' offer. Wholesale Prices and FREE Sample Kit.
MELLINGER TIRE & RUBBER CO.
Dept. 410 Philadelphia, Pa., or Kansas City, Mo.

HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will send you upon request sample copy Free containing Suggestions to Inventors as to Inventions Needed. We invite manufacturers to address us regarding inventions they want. Subscription for one year 60 cents.
WORLD PROGRESS PUB. CO., INC.
Room 202 Victor Bldg. Washington, D. C.

Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous
Frank Gotch and Farmer Burns offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.
Farmer Burns School of Wrestling, 1785 Range Bldg., Omaha, Neb.

A Game of Uncertainties

(Continued from page 130)

trainer, it is taught to "jog," then to canter, always with a well-trained older horse as a model, and in time it is ready for advanced studies at the starting barrier. This is a mechanical contrivance, developed in Australia—a strip of fabric that stretches across the width of the track and is sprung upward when the starter presses a button. The barrier is used at all race courses in America, and a horse's ability to "break" the instant it rises is of prime importance; for race horses attain top speed almost in their first stride.

"Schooling" at the barrier is conducted each morning by the official starter. It is a task that would try the patience of Job. In time, though, the young horses learn to stand reasonably quiet behind the barrier while it is down and to leap forward when it is "sprung."

THROUGH this period the youngsters are given slow "workouts" for "conditioning" purposes; that is, for the development of muscle and strength. No effort is made to test their speed, and meanwhile their owners and trainers do not know whether they are embryo champions or just good saddle horses.

When the young horse has learned the various gaits and has developed sufficient strength, he is given a speed trial. First, he is sent an eighth of a mile, or a "furlong," as the distance is usually called at the track, at top speed. If he can cover this distance in about twelve seconds, a quarter of a mile in about twenty-five seconds and a half mile in about fifty, he will "do," and his education is continued in the finer points of racing technic.

After the second January following his birth, the young horse is accounted a two-year-old, and if sufficiently "schooled," he is sent to the races.

Young horses making their debut ordinarily run half mile races at first. Later they run four and a half furlongs. Between May and October the standard distances for two-year-olds are five and five and a half furlongs, and occasionally six furlongs. In the late fall, when they are "seasoned," they compete in races of seven furlongs and a mile. In their second season of racing, as three-year-olds, they race against older horses and at all distances.

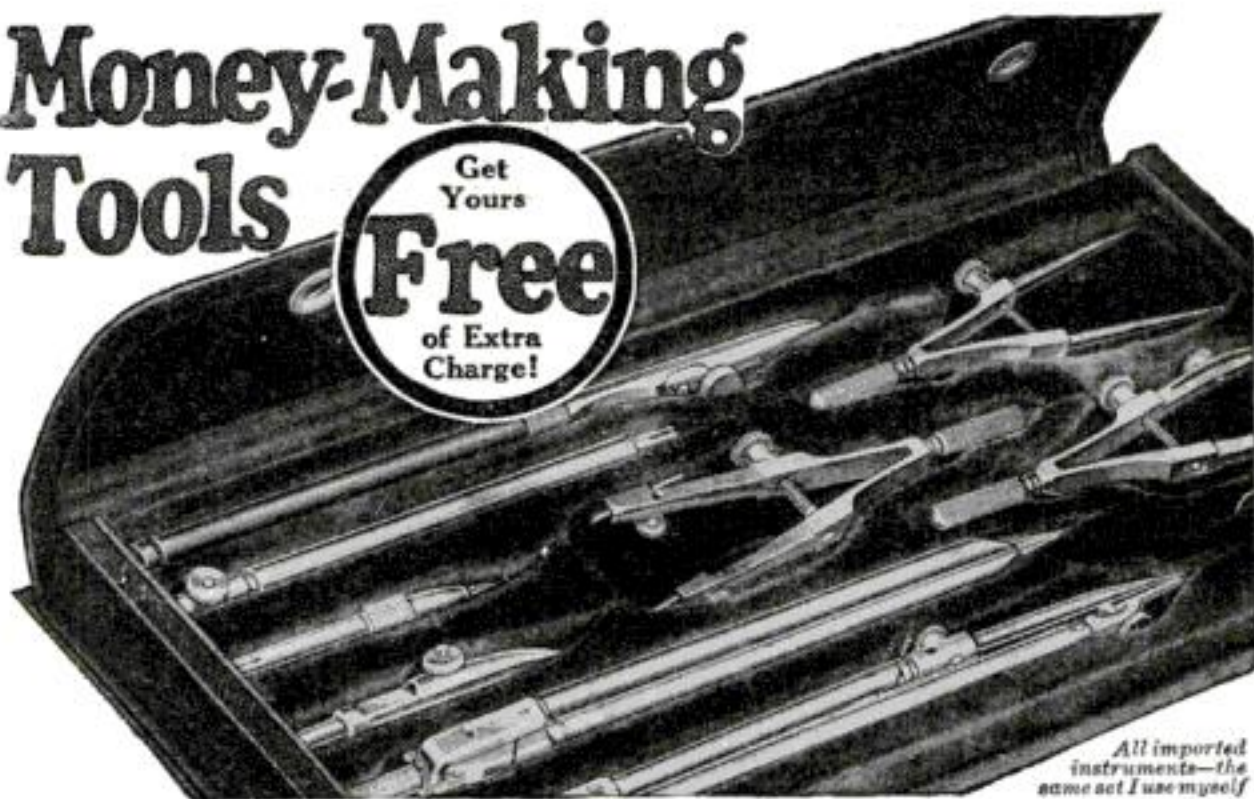
HORSES are handicapped by making the better horses carry heavier weights in their races. These are made up of the weight of the jockey and of lead pads placed beneath the saddle cloths.

If, after the long training period, there could be any certainty of performance, the breeding of race horses might be something of an exact science. But, as an exact science, it would lose much of its glamor, much of its appeal.

Any trainer will tell you that because a colt has shown dizzy flights of speed in trial gallops is no guarantee that he is destined for greatness in actual racing. Horses are not machines, but, like men, are subject to moods and caprices. Some horses are "front runners," and turn in their best races when leading (Continued on page 132)

Money-Making Tools

Get Yours
Free
of Extra Charge!



All imported instruments—the same as I use myself

Do You Need BIG Money? The Drafting Field Needs MEN! Get into the Line that is BEGGING for Help. A Line that's EASY to Learn! Read My Offer to FURNISH ALL TOOLS!



FRED K. W. DOBE M. E.

This offer holds good until all my mail classes are filled to capacity. Every industry is clamoring for draftsmen. Two hundred or more of the biggest concerns look to us first in filling drafting room positions. I want to keep their good will. I can't afford to disappoint them. So for the present, at least—I supply everything you need—tools and table—squares and triangles, pens and pencils, even the ink!

Not a penny extra for the tools that last a lifetime. Not a nickel for even the drawing paper and tracing cloth you need to get down to business. And I've made special terms—so easy you can earn the money five times over while I'm training you.

QUICK ACTION "HOW do I know the Dobe course can make me worth at least \$250 a month?" you may ask. I'll answer that one sentence! I train you until you are—and at the small tuition fees I get, I couldn't afford to take very long! One of my students is 51 years old; another is just seventeen. But they'll all be making a grown-up salary within a few short months! Will YOU?

MEN WANTED

DRAFTSMEN—\$3600 to \$10,000 a year; see Help Wanted ads in every newspaper. Twenty calls for draftsmen to one ad for electricians or mechanics. Shops may run part-time, or shut down, but they never stop designing and drafting. Did you ever hear of a draftsman who was laid off? No. The drafting offices are part of the business.

AGENTS Wear FREE Shirts



Wear my wonderful shirts and take orders at startling low prices. My offer includes a handy pocket-size book of actual samples absolutely free.

Make \$5 Others every Day-Extra

Everything you need to start comes absolutely free by return mail. Carry the handy sample book in your pocket. Show men in odd moments. Most men need more shirts. They snap up my amazing offer of 8 for \$4.50! The shirts are fine broadcloth, madras, flannel, percale, etc. You don't need experience. Men call it a privilege to buy at huge savings. You can sell every man in your territory and reap years of repeat business. You get big cash profits on every sale. We deliver and guarantee. Carry this shirt agency right in your pocket! Make up to \$10 every day just in odd moments, or up to \$100 a week, full time. Hundreds do! Just send name for FREE samples and offer of FREE Shirts. Do it right now. No obligation. Chas. Hope, FASHION WEAR SHIRT CO., 1200-20 Jackson St., Dept. E-171 Cincinnati, Ohio.

IMPORTANT! DRAFTING isn't "drawing!" You don't need any "talent." A draftsman uses tools for every line and every curve. You couldn't make them crooked if you tried! That's why drafting is so easily learned—and so interesting. For you do everything by rule! So, I guarantee to make anyone a finished draftsman; if you can read and write, you can learn this line.

PAYING POSITIONS loom up almost as soon as you are enrolled in a Dobe class! We receive requests daily for junior men—for men only partly through our course. "We'll take a beginner," some concerns write us, "so long as he is a Dobe trained man and has begun right!" Furthermore, a lot of our students are willing to carry special work for pay, right while their lessons go on. Learn drafting, and you'll have a trade on which all other trades depend. They can't build a barn without mechanical drawings. The simplest article can't be made until a draftsman has put every part in black and white.

YOU NEED NOTHING we don't furnish; that is, if you act now and get the offer that includes free tools and equipment without extra expense. But all I ask now is your name—just let me send you the particulars—and the handsomest illustrated book ever published about drafting! Use coupon:

CHIEF DRAFTSMAN DOBE, Div. 13-65
1951 Lawrence Ave., Chicago

Send me FREE and POSTPAID full information about your training, and enough material to show me how easy it is to learn drafting, and how I would like the work. Include your free tools offer.

Name..... Age.....

Address.....

P. O..... State.....

ART We Teach COMMERCIAL ART

Meyer Both Company, maintaining the most widely known Commercial Art Studios in the World, offers you a practical training based upon 25 years' success in producing over a quarter million drawings for leading advertisers. This attractive profession equally open to men and women. Home study instruction.

Get Facts Before You Enroll in Any School

Send 4c in stamps for illustrated book telling of the success of our students.

MEYER BOTH COMPANY

Dept. 35

Michigan Ave. at 20th St.
CHICAGO, ILL.



"The Boss Was Stumped"

"He was trying to figure out a way to speed up the machines. I could see he was stumped and I asked him if he would let me try my hand at it."

"Go ahead," he said, "but I don't believe you can help much. Looks like an outside job to me."

"So I started right in and pretty soon I had the whole thing worked out. The boss was watching me and I could see he was surprised."

"How did you learn all that?" he asked in that quiet way of his. And then I told him I'd been studying at home nights with the I. C. S.

"He didn't say anything and I thought he had forgotten about it until he called me in his office a few weeks later. He said he was going to make me foreman and increase my salary \$75 a month."

"Keep on studying," he told me, "and you'll get another promotion soon. You can't beat those International Correspondence Schools textbooks for good, sound practical knowledge."

That's a true story of what spare-time study has done for just one man. There are thousands of others. Why don't you take up a home-study course with the International Correspondence Schools and prepare yourself to earn more money?



Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 7693-D, Scranton, Penna.

Oldest and largest correspondence schools in the world

Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> French |
| <input type="checkbox"/> Illustrating | |

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Radio | <input type="checkbox"/> Mathematics |

Name.....
Street.....
Address.....

City.....State.....

Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

Music Lessons

WITH AN ACCREDITED SCHOOL

At Home

A Complete Conservatory Course By Mail Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

Any Instrument Write telling us course you are interested in—Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo, or Reed Organ—and we will send our Free Catalog with details of course you want. Send now.

UNIVERSITY EXTENSION CONSERVATORY
788 Siegel-Myers Building Chicago, Illinois

A Game of Uncertainties

(Continued from page 131)

the field from start to finish. Others are fleet but faint-hearted; they will get off like lightning, but quit to a walk when challenged by another racer.

Inconsistency of horses, and sometimes shocking "form reversals," attend every operation with the racing thoroughbred. A conspicuous example is that of the noted Morvich, winner of the Kentucky Derby in 1922.

THIS colt won his first race at Jamaica, N. Y., at odds of 40 to 1. He won his next start and his next and his next, all in hollow style. He took first place in every start he made that year. The next year, as a three-year-old, he romped to victory in the Kentucky Derby, and netted his owner, Benjamin Block, \$38,450.

And then, just when the wise men of the turf were ready to place the seal of greatness on Morvich, the colt's career on the track came to an abrupt end. He was ingloriously defeated in every start he made. So his owner retired him to the stud farm. As an investment Morvich paid generously, for he won \$172,909 during his career. To his owner, though, and to race-goers generally, he was a disappointment, a bursted bubble.

Or consider the case of Zev, Harry S. Sinclair's remarkable colt, whose winnings of \$313,639 in three years of racing broke all records for earnings by an American horse. Victor in the famous Kentucky Derby, in the international match race with the English Derby winner Papyrus, and in several of the richest American stake races, Zev seemed one horse that had earned the title "great."

Yet at the summit of his career, Zev developed cunning, became lazy and capricious. He had lost none of his amazing speed, but no jockey, no efforts of his trainer, could make him extend himself unless he wished. So he was withdrawn from racing.

Consider, also, that greatest of all American racers, Samuel D. Riddle's wonder horse, Man-o'-War. This marvelous performer stood in relation to the other horses of his time—perhaps to all other horses of history—as a diamond to a handful of pebbles. Yet once in his twenty-one starts he was beaten, unexpectedly and unexplainably, by a horse that oddly enough was called Upset.

THE hope of every man who races horses, professionally or as a hobby, is to possess himself of an animal that has the balance in speed, courage, endurance, action, health and temper that racing men call "class"—qualities that enable him to do anything his trainer asks of him; to run on wet tracks or dry, in sprints or long races, to carry weight, to withstand shipping from track to track, climatic changes; a horse, in short, for whom, winner or loser, no excuses have to be made.

Such a horse was Man-o'-War. Such horses were Exterminator, Roamer and Grey Lag of recent memory, and Sysonby, Domino and Salvator. Such a horse, probably, Pompey, last year's two-year-old champion, will prove to be.

TRAVEL—PRACTICALLY YOUR OWN BOSS EARN up to \$60 Per wk.

Fascinating Railway Work

TRAFFIC Inspectors travel near home or about the country; report confidentially to chief executives, opening way to fine advancements.

Due to contacts with many railways, we place graduates to earn at start \$28 to \$40 weekly, expenses paid, or refund tuition. Pay increases fast—up to \$250 monthly—with experience.

The only training-school of its kind. Easy, spare-time, home course quickly completed; inexpensive; terms given. Write for FREE Booklet No. L-64.

MORE MEN WANTED TO FILL POSITIONS Standard Business Training Inst., Buffalo, N. Y.



8th YEAR

Learn AUTO and Tractor TRADE

Become an Auto Expert. I train you in 8 weeks.

No apprenticeship. Why work four years for boy's wages? Be a man! No labor unions to join.

I Pay Your R. R. Fare while my short-time training offer lasts. Save ONE-THIRD NOW.

You learn with real tools on actual equipment. No text books required. Your money back if not perfectly satisfied.

Price training offer lasts. Save ONE-THIRD NOW. You learn with real tools on actual equipment. No text books required. Your money back if not perfectly satisfied.

100,000 experts needed right now to repair America's 20,000,000 cars.

FREE Write for big 64 page book and remarkable offer. Don't wait a minute.

MC SWEENEY
AUTO, TRACTOR and ELECTRICAL SCHOOLS
9th and Walnut Sts. Dept. 136 Cincinnati, O.

Men Wanted

to manufacture Metal Toys and Novelties. No salesmanship necessary. Demand exceeds supply and we co-operate with you in selling goods, also buy them from you. We put you in touch with the buyers. Guaranteed casting forms with complete outfit furnished for speedy production of Toys, Novelties, Ash Trays, Bookends, and other big all year sellers. Absolutely no experience or machinery necessary. No special place needed. Small investment puts you on road to success. You do the manufacturing and we take care of the selling. Act immediately if you want to handle big 1926 wholesale orders now being placed. Strictly a business proposition. Catalog and information mailed on request.

Metal Cast Products Co. 1636 Boston Road, New York

LAW Free Book

Write today for FREE 128-page book, "THE LAW TRAINED MAN," which shows how to learn law in your spare time and earn more money. Qualify for a high salaried executive position or prepare to enter the practice of law. Study at home through the Blackstone Course prepared by 80 prominent legal authorities including CHIEF JUSTICE WILLIAM HOWARD TAFT.

Blackstone graduates practicing law everywhere. J.D. degree conferred. Magnificent 25 volume law library furnished immediately upon enrollment. Moderate tuition fee. Low monthly terms. Money Back Guarantee. Write for booklet today.

Blackstone Institute, Inc., 4753 Grand Blvd., Dept. 125 Chicago

America's Foremost Non-Resident Law School

AGENTS 500% PROFIT GENUINE GOLD LEAF LETTERS.

S Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits. Paul Clark says: smallest day \$28.70. R. L. Reel made \$920 in two months. Write today for free sample and liberal offer to general agents.

METALLIC LETTER CO., 433A N. Clark Street, Chicago.

Learn to Write

Begin today—write for my FREE BOOK. I can make a good penman of you at home during spare time. Write for my FREE BOOK, "How to Become a Good Penman." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. Write today for book.

F. W. TANBLYN, 437 Ridge Bldg., Kansas City, U.S.A.

A 2c STAMP—

will start you on the road to success. See Money Making Opportunities on pages 116 to 142.

Only the Daring Can Work for Him

(Continued from page 32)

Ernest's feet, trying to turn him over the third time before the flier hit the net. But Ernest's head was twisted just a little to one side as it met knotted ropes. He died three days later.

Within a week of Lane's death in Chicago, another flier, Jack Ernest, who also trained in Eddie Ward's Bloomington barn, died in Rio de Janeiro. Jack was trying a two-and-one-half forward somersault. The particular danger in this trick is that the flier is revolving face forward and if he misses his catcher's hands is apt to meet the net that way. Jack missed his catcher's hands and died from a broken back.

"I'VE had a good many of them in the hospital from time to time," says Eddie, "but those are the only two fliers I ever lost."

I've never been able to find out just why fliers continue to flirt with gravity when they could earn almost as much money doing less dangerous and more easily mastered acts. It takes four years to make a flier. Eddie has some one on the injured list nearly all the time. Yet his Bloomington school for fliers never lacks applicants. He always has a waiting list. Perhaps it is because he has a way of making stars out of them.

Twice each year for three years, Bert Ward has dived from the top of the rigging to the net, thirty-one feet below, and during his thirty-one foot fall has turned a backward somersault—a double pirouette—a horizontal double revolution—and another back somersault, before he has flipped his body over and landed on his "balled up" shoulders. Bert, who is 22 and weighs 138 pounds, will, in all probability, break his neck if he miscalculates the tenth part of a second. But he learned the trick with a safety belt, and since he took the belt off has not miscalculated—yet.

"Why do you do that fancy trick?" I asked Bert at Schenectady, N. Y., last summer. "It will get you sometime."

BERT looked at his chief, as the two sat on their dressing-room trunks. "Why do I do it?" he asked the veteran.

"Why does a man want to be president of the United States?" Eddie countered. "I was in the 1918 railroad wreck near Gary that killed my sister and another girl in our company and jammed up every one else in the act. I've hung head downward longer than any man on earth. I own a valuable home in Bloomington. I own a farm near Cedar Rapids, Iowa.

"I don't have to dress in tights and do stunts for the towners twice a day in all kinds of weather. I don't have to put a level and tape lines on my riggings to be sure they are hanging straight. I don't have to figure on gravity day in and day out. I don't have to do a lot of things that are difficult, dangerous, and sometimes disagreeable. Neither does Bert or any member of my company.

"But a fellow gets a kick out of doing any star act, in a circus or out of it. It's great stuff while it lasts."

\$542⁰⁰ Earned IN ONE MONTH

A Big Money-Making Business

A Business to Enthuse Over—The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

FRED C. MILKERT OF ROSELLE, ILL., WRITES: "The Ideal Lawn Mower Sharpener put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

W. F. Kendt, Buffalo writes: "I sharpened 994 lawn mowers last season, and the receipts were nearly \$2100.00 which is not bad for a side line."

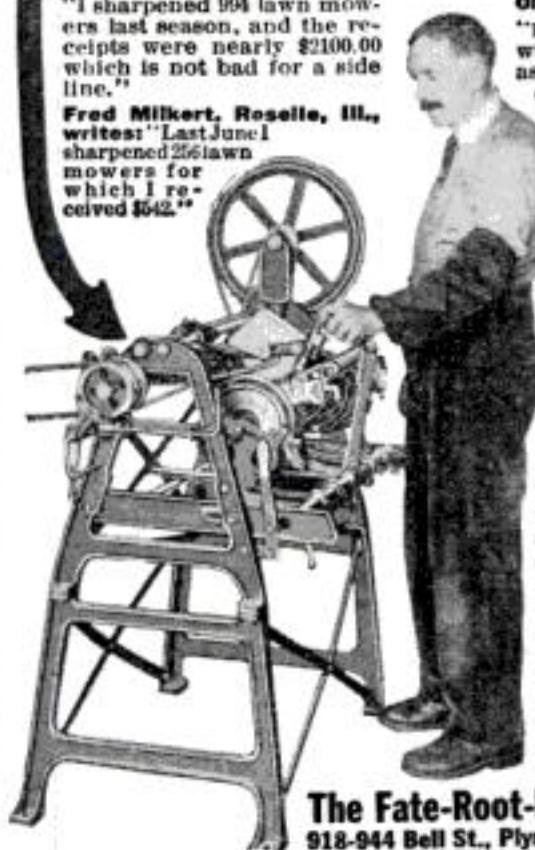
Fred Milkert, Roselle, Ill., writes: "Last June I sharpened 256 lawn mowers for which I received \$542."

Zeno Brandon, Middletown, Ohio, writes:

"I made \$830.70 in 65 days with my 'Ideal'. Have made as high as \$38.70 in one day."

E. W. McCormick, Saginaw, Michigan, writes:

"I have ground over 5,000 mowers during the past five years besides working at my trade."



You Start Now

No town too small. D. S. Newcomer of Vinton, Ia. writes: "People come from miles around and from other towns to have their mowers ground." Lawn mowers are dull—owners don't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing healthful, invigorating and pleasant when mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

Lawn Mowers Sharpened to Razor Edge—

People glad—owners delight in mowing lawn with mower sharpened on an "Ideal". Mowers run light—click-click and the grass is cut. Build permanent business for yourself. Start now!

Write Today

FREE Detailed illustrated catalog and booklet "Let George Say It." Write today.

USE THIS—MAIL IT TODAY

The Fate-Root-Heath Company
918-944 Bell St., Plymouth, Ohio
Please mail at once free Illustrated Catalog and Booklet "Let George Say It."

Name.....

Address.....

The Fate-Root-Heath Co.
918-944 Bell St., Plymouth, Ohio

Electricity needs men like You

HERE is the chance of your lifetime to start in this business and start right by actual electrical experience in the Greer Shops. This 12 weeks training starts you into any branch of Electrical or Radio fields. Earn while learning if you wish. R. R. fare paid to Chicago on cash enrollments. Excellent tool outfit free with course. Send the coupon below now for full information about this wonderful training plan.

This was formerly the U. S. Government Veteran Bureau course, equipped at cost of about a quarter of a million dollars. When Congress discontinued the course for veterans, we bought this marvelous equipment and added it to the Greer Shops. The same chief instructor who was in charge for Uncle Sam has been kept to supervise the work—the man who perfected this wonderfully effective system of training.

Learn Quickly, Thoroughly Here

Here you learn by actual practice on real, high class equipment, under supervision of electrical experts. Simple experiments begin the first day. The thrill of accomplishment grips you—the joy of mastering this great friendly giant power—Electricity—and making it do what you wish. One great advantage of our system is the individual instruction. You go ahead as fast as you are able without being held back because some one else is slow.

Complete, Up to Date Equipment

Over 200 motors, complete line of motor starters, over 300 testing instruments—voltmeters, ammeters, etc. Armature and stator department has latest equipment for winding, taping and forming. Bungalow right in the shop—for learning house wiring. Load testers, rotary converters, alternating current generator, high tension line, automatic telephone panel. These are some of the devices you learn about by actual use here. Last, but not least, we recently took over one of the largest strictly radio schools in the country.

Free Employment Service

We help you to get the right start in every way we can. Many of our graduates go into business for themselves soon after finishing this training. This moment is one of the greatest turning points of your life. If you do not find out all about this marvelous opportunity, you have only yourself to blame. Send the coupon right now, and get full information by return mail.



A 25 H.P. Motor for student practice



Clip this Coupon. Send it NOW! Address me personally, please. Erwin Greer, President.

Erwin Greer, President,
Greer College of Electrical Engineering,
Dept. 502, 2024 S. Wabash Ave., Chicago.

Please send me full information and special offer for electrical course. It is understood that I am not obligated in any way.

Name.....

Address.....



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY if you lack **HANDICAPPED** High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This course,

which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School

Dept. H-575

Drexel Ave. and 58th St., Chicago

American School

Dept H-575 Drexel Ave. & 58th St., Chicago

Send me full information on the subject checked and how you will help me win success.

- | | |
|------------------------------|----------------------------|
|Architect |Business Law |
|Building Contractor |Lawyer |
|Automobile Engineer |Machine Shop Practice |
|Automobile Repairman |Mechanical Engineer |
|Civil Engineer |Shop Superintendent |
|Structural Engineer |Employment Manager |
|Business Manager |Steam Engineer |
|Cert. Public Accountant |Foremanship |
|Accountant and Auditor |Sanitary Engineer |
|Bookkeeper |Surveyor (& Mapping) |
|Draftsman and Designer |Telephone Engineer |
|Electrical Engineer |Telegraph Engineer |
|Electric Light & Power |High School Graduate |
|General Education |Wireless Radio |
|Vocational Guidance |Undecided |

Name.....

Address.....

Moths Cost Us Millions

(Continued from page 33)

out-of-doors in the hot sunshine for a day or two, if possible, before putting them away. If it will not hurt the material, press it with a very hot iron, using a wet towel on the goods. Soaking goods in boiling hot water for half a minute likewise will destroy moth eggs, and washing in a strong soap solution is effective.

FOR safe storage, cedar chests and cedar-lined closets are effective if they are kept shut tight. Open them only to put in and remove clothing. While the aroma of cedar kills the young worms, a cedar chest will not kill the millers or half-grown worms that are already in the clothing when it is stored away.

The simplest precaution is to store your clothing in air-tight containers. Paper bags will do if you make sure that they are sealed tight and there are no tears, or protruding hangers, in them.

Wrapping in several thicknesses of newspapers is also effective. Plain paper does as well. Or, pack your clothes in pasteboard suit boxes and seal them.

When your clothes become old, give them away. Every garment, especially if made of wool, hung on a hook at the back of the closet, is a fine home for moths.

While you are giving things away, you might as well include the old stuffed furniture stored in the attic. One piece of it will furnish lodging for a thousand moths which, later, may explore more interesting regions downstairs. Look out for the furniture that is in use, too.

IF YOU have a piano, lift off the front and inspect the felt inside. This is a favorite hiding place for moths.

Cold storage will prevent moths from attacking furs, but you can care for furs at home if you will brush, beat and air them thoroughly once every two or three weeks during the summer.

Naphthalene in the form of moth balls or flakes will kill moths in all stages, but only if packed with clothes in a tight container. In a chest or trunk, allow one pound of naphthalene for ten cubic feet of space. Gum camphor fumes are destructive to moths, also only when confined in an air-tight container.

Should you discover a closet or room infested with moths, the best thing to do is to fumigate it with carbon disulphide or carbon tetrachloride, both colorless liquids which produce gases. Set a cupful of either liquid in a shallow pan on a shelf of the closet, shut the door, seal the cracks with paper tape, and leave it over night. Carbon disulphide is the more powerful chemical, but it is inflammable. Carbon tetrachloride is not inflammable.

Many methods formerly used for destroying clothes moths are useless, experiments have shown. Lavender flowers, pepper, powdered borax, salt, cedar chips, tobacco powder, and powdered sulphur are among the time-honored moth chasers that do no real good. While you are about it, you may as well use preventives that are known to work.

And if you see troublesome little clothes moth millers flitting or crawling about this summer, swat them.

TRUSS GOES 5th-Day or No Pay Magic Dot Does It

Amazing little invention actually anchors new kind of support. It weighs little more than a collar button and is revolutionizing the treatment of rupture. Sold on free examination privilege. Results quick. Clean comfortable. Why wear ox-harness when this remarkable new appliance awaits you? Write today for the most interesting free book you have ever read. The New Science Institute, 4024 Clay St., Steubenville, Ohio



I Pay Him \$40 A DAY!

S. W. Allen of California made \$40.80 in one day's "joyful work"! Hundreds of other men are reporting amazing incomes—many of them doubling and tripling their former salaries.



Just Wear This FREE Cap

Just wear this beautiful hand tailored FREE RAIN-PROOF Cap. When your friends see it, nine out of ten will want one like it. They can't resist the Rain Proof idea—it's so new and unique. You can make a splendid income in full or spare time. No experience is needed. "I haven't found a man who doesn't fall for the made-to-measure idea," writes Chas. Horstman. Send at once for FREE Selling Outfit. Taylor Cap Mfrs., Dept. E-107, Cincinnati, Ohio.

Electrical

Condensed course in Theoretical and Practical Electrical

Engineering

including the closely related subjects of Mathematics and Mechanical Drawing taught by experts. Students construct motors, install wiring, test electrical machinery. Complete Course.



In One Year

Prepare for your profession in the most interesting city in the world. School established 1893. Send for catalog. BLISS ELECTRICAL SCHOOL 475 Takoma Ave., Washington, D. C.

Local Demonstrator Wanted

The marvel of the age, the only fireproof paint. Demonstrate on any vacant lot, thousands will come to see it. Endorsed by all fire departments. No talking necessary, no canvassing. Makes even the newspapers write about it. One of our specially prepared demonstrations sets the whole town talking. No money needed for stock. We ship on your orders and collect for you. Many make \$15.00 a day and not interfere with their present work. Write today before someone else gets your territory. Fire Chief Paint Co., 124 West Acstin Ave., Chicago



SOUNDS IMPOSSIBLE

After application of the magic liquid NOBURN you can stay in the hottest sun all day without any sunburn. Order bottle now. Pay \$1 later. NOBURN must make good before you pay. S-rong, Cobb & Company, 348 Central Viaduct, Cleveland, O.



Many Agents Earn \$100 A Week Selling Shirts.

Others Earning \$100 Weekly selling direct to wearer. Custom Quality Shirts made by Carlton, 5th Ave., N. Y. America's greatest shirt values, silks, staples and exclusive patterns. We deliver and collect. Your profit: 25% paid daily. Big, beautiful sample outfit FREE. Permanent position. Salesmen and Saleswomen write today for outfit.

CARLTON MILLS, INC., 98 FIFTH AVE. Dept. 86-C NEW YORK

\$100 in Prizes
See Cash Prize Offer on Page 4 in front advertising section

Reduce This Fleshy Spot

DON'T weaken yourself with starvation diets—don't strain your heart with violent exercises. Here's a wonderful new invention which gives you an instant appearance of slimmness and quickly reduces the actual fat—without any danger, discomfort or disagreeable self-denial!

Take Off 2 to 6 Inches With New Self-Massaging Belt

The moment you put on this wonderful, new, self-massaging belt your waist is instantly reduced from 2 to 6 inches—but, better still, you should actually grow thinner day by day. At the same time all your stomach disorders, constipation, back-aches and shortness of breath generally disappear as the sagging internal organs are put back in normal place. You are filled with a wonderful new energy and look and feel 10 to 15 years younger!

Like Having a Private Masseur

This new, wonderful Weil Reducing Belt produces the same results as an expert masseur—only quicker and cheaper. It not only reduces your waistline when you put it on, but is so constructed that every movement you make, every breath you take, imparts a constant, gentle massage to every inch of your abdomen. In a few weeks inches and inches of fat should actually disappear.

The Weil Belt is made of the same kind of scientifically treated rubber that is used by hundreds of professional athletes and jockeys and is highly endorsed for its healthful principles by physicians everywhere. Satisfaction guaranteed or your money instantly refunded without question. The Weil Co., 105 Hill St., New Haven, Conn.

THE WEIL COMPANY,
105 Hill St., New Haven, Conn.

Gentlemen: Please send me, without obligation, complete description of the Weil Scientific Reducing Belt and also your special 10-day trial offer.

Name.....

Address.....

City..... State.....

Clear Your Skin!

Your Skin Can Be Quickly Cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch, Eczema, Enlarged Pores and Oily or Shiny Skin.

FREE Write today for my FREE BOOKLET, "A CLEAR-TONE SKIN," telling how I cured myself after being afflicted 15 years. \$1000 Cash says I can clear your skin of the above blemishes. E. S. GIVENS, 153 Chemical Bldg., Kansas City, Mo.

Learn to Mount Birds

Learn at home to mount birds, animals, game heads; tan furs, make rugs and robes. Complete lessons. Easily and quickly learned by men, boys and women.

FREE Write for Free Taxidermy Book. Tells all about it. Every sportsman, trapper and Nature lover should know this wonderful fascinating art. Save your trophies. Big profits. Success guaranteed. 75,000 graduates. Investigate. Write for Free Book. Northwestern School of Taxidermy 1785 Elwood Bldg., Omaha, Neb.

Learn Aviation

Taken W. A. C. Course in Applied Airplane Engineering. Many men earn \$2,000 to \$10,000 a year. Big Free outfit of airplane parts. Write for Free Catalog. WESTERN AIRPLANE CORPORATION Dept. P-5 Menard Bldg., Chicago, Ill.

Start a Movie Show
SMALL CAPITAL STARTS YOU
Big opportunity to become independent. No experience needed. We show you how. Our easy payment plan makes it easy to start. We equip you complete. Our machines used and endorsed by government institutions. Write today for free catalog. ATLAS MOVING PICTURE CO. 536 S. Dearborn St., Dept. T, Chicago

He Lived Two Great Lives

(Continued from page 18)

"Well now, sir, I have tried you long enough. Now you have learned it is not numerous drawings, but the character of one that makes a thorough draftsman. Finish one picture, sir, and you are a painter!"

It was with this fatherly advice in mind that Morse, on the day after the *Sully* arrived in New York in 1832, began at middle age his new career, and undertook the task of perfecting the first model of his telegraph.

HE WENT directly to the home of his brother, and there, melting lead at the fireplace in the front parlor, proceeded to spill the molten metal on the rugs and chairs, much to the consternation of his brother's wife. Next he moved to a little garret room on the fifth floor above a newspaper office run by his two brothers at Nassau and Beekman streets. This room served as his living room, kitchen, bedroom and workshop. On one side of the room was his small cot; on the other side a lathe on which he turned brass apparatus used in building his instruments.

Here he toiled feverishly and incessantly. Here was repeated the old story of inventive genius contending with poverty. His funds had been exhausted in Europe. He was compelled to live on the plainest of foods prepared with his own hands. To support himself, he had to fall back on his paintbrush and to earn his bread by giving lessons in art.

His friends called him "visionary"; others called him a "mad prophet." His hands were little accustomed to the mechanical labor which he was undertaking. No electrical apparatus was available for his use; all of it he had to make himself. He whittled models for his apparatus from wood; then from the models made molds and castings.

In designing his "recording telegraph," his problem was to utilize the simple up and down motion of opening and closing an electric circuit to write an intelligible message at one end of the wire and at the same time record it at the other.

HIS solution was ingeniously simple. First, by means of clockwork, he caused a ribbon of paper to move horizontally beneath a pencil. The pencil moved up and down. When it touched the paper it made either a dot or a dash, according to the length of time it remained there. When lifted from the paper, it left a blank. Each of the various combinations of dots, dashes, and blanks represented a letter. The movements of the pencil were produced by an electromagnet actuated by a type rule or key which opened and closed the electric circuit according to the combination of dots and dashes desired.

Three years after the inception of his idea aboard the *Sully* the first rude telegraph apparatus was completed. Its birthplace was in the University of the City of New York, where Morse had been called as professor of arts and design.

It worked! At the university, in 1837, Morse demon- (Continued on page 136)

Scatter-brained!

No wonder he never accomplishes anything worthwhile!



HIS mind is a hodge-podge of half-baked ideas. He thinks of a thousand "schemes" to make money quickly—but does nothing about any of them.

Thoughts flash into and out of his brain with the speed of lightning. New ideas rush in pell-mell, crowding out old ones before they have taken form or shape.

He is Scatter-Brained.

He wonders why he does not get ahead. He cannot understand why others, with less ability, pass him in the prosperity parade.

He pities himself, excuses himself, sympathizes with himself. And the great tragedy is that he has every quality that leads to success—intelligence, originality, imagination, ambition.

His trouble is that he does not know how to use his brain. His mental make-up needs an overhauling.

There are millions like him—failures, half-successes—slaves to those with balanced, ordered minds.

It is a known fact that most of us use only one-tenth of our brain power. The other nine-tenths is dissipated into thousands of fragmentary thoughts, in day dreaming, in wishing.

What can be done about it?

Find out by means of Pelmanism; then develop the particular mental faculty that you lack. You can develop it easily; Pelmanism will show you just how; 550,000 Pelmanists, many of whom were held back by your very problem, will tell you that this is true.

Pelmanism is the science of applied psychology, which has swept the world with the force of a religion. It has awakened powers in individuals, all over the world, they did not dream they possessed.

Among those who advocate Pelmanism are:

T. P. O'Connor, "Father of the House of Commons."	Jerome K. Jerome, Novelist.
The late Sir H. Rider Haggard, Famous Novelist.	Gm. Sir Frederick Maurice, Director of Military Operations, Imperial General Staff.
General Sir Robert Baden-Powell, Founder of the Boy Scout Movement.	Admiral Lord Bessford, G.C.B., G.C.V.O.
Judge Ben B. Lindsey, Founder of the Juvenile Court, Denver.	Sir Harry Lauder, Comedian.
Frank P. Walsh, Former Chairman of National War Labor Board.	W. L. George, Author.
	Baroness Orczy, Author.
	Prince Charles of Sweden.

—and others, of equal prominence, too numerous to mention here.

A remarkable book called "Scientific Mind Training" has been written about Pelmanism. It can be obtained free. Yet thousands of people who read this announcement and who need this book will not send for it. "It's no use," they will say. "It will do me no good." "It's all tommyrot," they will tell themselves.

But if you are made of the stuff that isn't content to remain a slave—if you have taken your last whipping from life—if you have a spark of independence left in your soul, write for this free book. It tells you what Pelmanism is, what it has done for others, and what it can do for you.

The first principle of your success is to do something definite in your life. You cannot afford to remain undecided, vacillating, day-dreaming, for you will soon again sink into the mire of discouragement. Let Pelmanism help you find yourself. Mail the coupon below now—while your resolve to do something about yours is strong.

THE PELMAN INSTITUTE OF AMERICA

Approved as a correspondence school under the laws of the State of New York

19 West 44th St. Suite 875 New York City

The Pelman Institute of America,
19 West 44th St., Suite 875,
New York City.

I want you to show me what Pelmanism has actually done for over 550,000 people. Please send me your free book, "Scientific Mind Training." This places me under no obligation whatever.

Name.....

Address.....

City..... State.....



"I was kicked into selling by my boss"

Harry Jordan was talking to his old friend Bill Thompson, whom he hadn't seen for years. "Bill, you know I worked on inside detail jobs for five years, and I couldn't get beyond \$100 a month to save my soul. I was pretty much discouraged."

"One night the chief took me to dinner with him, and asked me how I'd like to try sales work. I told him I didn't think I could do it. But he said he'd back me to the limit, and knew I could make good. Said the best salesmen the firm had came up from the ranks just like me. He had more faith in me than I had in myself."

"Well, Bill, we tried it, and it was the best thing ever happened to me. Now I'm making \$500, \$600, or \$700 a month regular, and the day isn't far off when I'll be hitting around \$10,000 a year."

Why Don't YOU Become a Salesman?

Don't wait for the boss to "discover" you and kick you into a big-money job. That wastes too much time. It's no longer necessary to blunder in sales work either. Send the coupon below at once, and find out for yourself what amazing results can be secured by the Federal System of Sales Training, fully described in this book "The Vital Spark in Business." Please state age and occupation.

Federal School of Salesmanship

352 Federal Schools Bldg.,
Minneapolis, Minn.

Please send your book, "The Vital Spark in Business."

Name.....

Age..... Occupation.....

Write your address plainly in margin

"STAMMERING Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents, coin or stamps, for 288 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.

BENJAMIN N. BOGUE

7529 Bogue Bldg., 1147 N. Ill. St. Indianapolis

DRAW CARTOONS

Turn Your Talent Into Money

Cartoonists earn from \$50 to \$300 per week—some even more. Remarkable new Circle System of Drawing teaches you in half the usual time. Send for booklet and sample lesson plate explaining full details of the Course.

THE NATIONAL SCHOOL OF CARTOONING
615 Penton Building Cleveland, Ohio



He Lived Two Great Lives

(Continued from page 135)

strated his invention to an astonished group of scientists, transmitting telegraphic signs through 1700 feet of wire strung back and forth across the room. The same year he applied for a patent at Washington for the "American Electromagnetic Telegraph." Another year brought the first public demonstration and the successful transmission, over ten miles of wire, of the first sentence ever recorded by telegraph:

"Attention, the Universe! By kingdoms, right wheel!"

TO MORSE, it seemed as if the final triumph for his labors must be just ahead. He had added a number of important improvements to his apparatus. He had invented the electric relay, one of the most brilliant of all his achievements, which made possible transmission through infinitely great distances.

In his code, he had replaced the original numbers with letters of the alphabet. And, not the least important, he had enlisted the interest and financial support of a young student in the university, Alfred Vail, the grandfather of the late Theodore N. Vail, founder of the American Telephone and Telegraph Company.

With high hopes, he was encouraged to go to Washington to ask the support of Congress for the construction of the first telegraph line. There, in the Capitol, he set up his apparatus and demonstrated it before President Van Buren and his cabinet, members of Congress, foreign ministers, and men of science. And finally he submitted a memorial to Congress for an appropriation of \$30,000 to establish an experimental telegraph line.

THIS done, he hurried to Europe to obtain foreign patents, leaving his American affairs in the hands of friends and supporters. In England his mission failed, but in France his invention created a sensation. There he was honored by foremost scientists of the day.

Returning in 1839, he was full of confidence that his own country would support him with equal enthusiasm. But he had not figured on the apathy of his public, of Congress, and even of his friends.

No sooner had he landed in New York than he found all his hopes dashed to the ground. In two years Congress had failed to act. His friends were scattered.

He found himself stranded in New York without a cent, compelled to borrow money even for a meal. Plunged to the depths of disappointment and want, he turned again to his easel and his brush for a living. Again he became a teacher of art.

One day, to a pupil whose quarterly payment for instruction was past due, Morse remarked:

"Well, my boy, how are we off for money?"

"Professor, I'm sorry I have been disappointed," the pupil replied, "but I expect the money from home next week."

"Next week!" Morse exclaimed. "I shall be dead by that time!"

"Dead, sir?"

(Continued on page 137)



LEARN BY DOING

Every phase of all branches

ELECTRICITY

taught by

Actual Practice

In America's foremost and oldest institution for trade training

No Books Used

Individual Instruction
Start Any Day

Write for FREE 64-page catalog

**THE NEW YORK
ELECTRICAL SCHOOL**

40 West 17th St., New York City

Play a Tune In 10 Minutes

OR SEND IT BACK
Anyone can play the Ukulele, Tenor Banjo, Mandolin, or Guitar, in ten minutes with this wonderful new device. Works like a typewriter—just press the keys. Play by numbers instead of notes.

Amazing New Invention

No knowledge of music needed. No expensive lessons. No weeks of tiresome practice. So simple a child can use it. Praised by prominent musicians. Thousands of delighted users. Astonish your friends with your playing. Become popular! New pleasures.

New money-making opportunities!

Send for FREE book, also catalog of musical instrument bargains. No obligation to buy.

FERRY & CO., 1222 N. Halsted, Dept. 8785 Chicago

I Made \$21.00 In Five Hours

—Writes Peter Werner, III, Sell Madison "Better-Made" Shirts for Large Manufacturer Direct to wearer. No capital or experience needed. Many earn \$100.00 weekly and bonus.

Write for Free Samples

MADISON SHIRT M'FRS, 562 Broadway, New York

A FILE

A FILE

Stop Forgetting

Make Your Mind an index from which you select facts, figures, names, facts. Develop concentration, self-control, overcome bashfulness, forgetfulness. Write today for FREE memory and concentration test and illustrated booklet, "How to Remember."

PROF. HENRY DICKSON
Dept. 929, Evanston, Ill.

AGENTS-NEW AUTO DEVICE

PREVENTS ACCIDENTS

SENSATIONAL money-maker. Rhanney sold 108 in few days, now orders 1000 a month. Magic new glare shield banishes fear of night driving. Dims blinding headlights. Same natural principle as shading eyes from sun—yet full vision.

Over 100,000 Sold

Many Make
\$25
A Day

Fits any car. Owner can install. Nothing to get out of order. Handsome ornament. Amazing low price, yet highest commissions. Startling demonstration sells quickly. Big demand proved by over 100,000 sales. Exclusive rights closing fast. Learn unusual automatic profit plan. Write quickly.

LEE-SEE CO., Dept. 65, Kewaunee, Wisconsin



LEARN MUSIC AT HOME

New Quick Easy Way

Amazing new method has already enabled almost half a million people to play their favorite instrument. You, too, can learn—in a few months—for a few cents a day—without a teacher!

This method is quick and easy because it's natural. You begin with familiar tunes. Directions clear as crystal tell you what to do. Pictures plain as day show you how to do it. Before you know it you are playing all your favorites—ballads, classical numbers or jazz. You can't go wrong with this wonderfully simple method. It's easy as A. B. C.!

It's Fun Learning

One of the reasons for the quick results is that learning is such fun. No tedious scales, no laborious exercises. Your progress is so rapid your friends will be amazed. Big financial opportunities for good musicians to earn \$60 to \$150 a week playing in orchestras. Always a big demand for them.

Free Book and Demonstration Lesson

describes this wonderful musical opportunity. Send for them today before copies are exhausted. You'll be astounded, thrilled, fascinated at the Free Demonstration Lesson which explains this easy, rapid way to become a veritable master of your favorite instrument. Name below the instrument you are particularly interested in. Instruments supplied when needed, cash or credit. U. S. School of Music, 85 Brunswick Bldg., New York City.

PICK YOUR COURSE

Piano	Cello
Organ	Harmony and Composition
Violin	Sight Singing
Drums and Traps	Ukelele
Banjo, (Tenor, Plectrum or 5-String)	Guitar
Mandolin	Hawaiian
Clarinet	Steel Guitar
Flute	Harp
Saxophone	Cornet
	Piccolo
	Trombone
	Piano Accordion
	Voice and Speech Culture
	Automatic Finger Control

U. S. School of Music,
85 Brunswick Bldg., New York City.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane. Demonstration Lesson and particulars of your Special Offer. I am interested in the following course:

Have You
Instrument?

Name.....
(Please write plainly)

Address.....

City..... State.....

ARE YOU SELF-CONSCIOUS? DO YOU STAMMER?

You must overcome Self-Consciousness—Mental Fear—Bashfulness to succeed in the business and social world. Send 10c for amazing booklet, "Road to Poise and Achievement." Tells how thousands have conquered Self-Consciousness in a very short time.

SEYMOUR INSTITUTE, 38 Park Row, Dept. PS., New York City.

Learn Advertising at HOME

Advertising men are among highest paid in the world. You can learn easily and quickly at home during your spare time. Bigger opportunities now in advertising than ever before. Tremendous demand for our graduates at big pay.

Send for **FREE Book** Giving interesting information and vital facts—just what you want to know about advertising. Write today:
PAGE-DAVIS SCHOOL OF ADVERTISING,
Dept. 1365 3601 Michigan Ave., Chicago, U. S. A.

He Lived Two Great Lives

(Continued from page 136)

"Yes, dead, by starvation."
"Would ten dollars be of any service?"
"Ten dollars would save my life," said Morse. "That's all it would do."

The youth paid the ten dollars, the last he had, and they dined together. When the meal was ended, Morse said: "This is my first meal in twenty-four hours. My boy, don't be an artist. It means beggary. A dog lives better."

In a final desperate effort to arouse public interest, Morse planned the first public demonstration of a submarine telegraph. He announced that he would string a line under water between Castle Garden in New York and Governor's Island, and that on a certain day the public could witness the exchange of messages. Doubters were invited to attend the demonstration.

THE night before the test, Morse hired a rowboat and laid the cable himself. Early the next morning a crowd assembled at the Battery to witness the new wonder.

Morse, at his instrument, exchanged a few signals with his associate at the other end on Governor's Island, when suddenly the line went dead.

Looking out over the water, he quickly saw what the trouble was. Above the cable during the night a number of vessels had anchored. One of them, in raising anchor, had pulled up the cable with it. The mystified sailors, after hauling aboard 200 feet of the wire and finding no end to it, had cut it off and sailed away. The crowd on shore jeered.

But still he refused to be beaten. As a last hope, he appealed to his associates for funds to go to Washington again for government aid. For reply, he received good wishes and nothing more.

Notwithstanding, Morse went to Washington. How he did so is not recorded, but again he placed his invention in the Capitol. Day after day he stood there explaining, sometimes almost tearfully, its mysteries to indifferent congressmen. Some believed in him. Others scoffed.

THE appropriation bill of \$30,000 for the telegraph was introduced. But the weeks dragged by, and no action was taken. And then happened one of those strange miracles which time and again have come to reward inventors who have refused to quit. In the closing hours of the session, at the moment when all hope had gone glimmering, the appropriation passed both houses of Congress!

Morse, who now had less than a dollar in his pocket, was selected to superintend the construction of a forty-mile telegraph line connecting Washington and Baltimore. Within the year the line of poles and wires was completed.

May 24, 1844, was the day for the test of the experiment on which Morse had labored for twelve years. Seated at his instrument, surrounded by high government officials, the inventor flashed to Vail in Baltimore the famous message: "What Hath God Wrought!"

The artist-inventor's greatest masterpiece was finished.



Needed in Aviation!

DO you love adventure? Do you want to make big money? Although aviation is still in its infancy there is a crying demand for men with courage, nerve, and self-reliance—ambitious men who are looking for a new field. For those who qualify there will be thousands of highly paid jobs.

Amazing Opportunity in the Airplane Industry

Yes, as yet, aviation is in its infancy, but now is the time to get in. In the automobile industry and in the moving picture business hundreds of men got rich by getting in at the start. They made their success before others woke up.

Fascinating — Daring — Big Paying

Prepare Now for One of These Positions

Aeronautical Instructor	\$60 to \$150 per week
Aeronautical Engineer	\$100 to \$300 per week
Aeronautical Contractor	Enormous profits
Aeroplane Repairman	\$60 to \$75 per week
Aeroplane Mechanician	\$40 to \$60 per week
Aeroplane Inspector	\$50 to \$75 per week
Aeroplane Salesman	\$5000 per year and up
Aeroplane Assembler	\$40 to \$65 per week
Aeroplane Builder	\$75 to \$200 per week

Think how much aviation has progressed in the last few years. Commercial air lines have already proved themselves successful both in Europe and America. Great men predict that in the near future there will be air-freight lines—organizations as large as our railroads are today. AVIATION IS NEW. It clamors for every young man.

Be an Aviation Expert—\$50 to \$100 a week

The study of aviation is as fascinating as the actual work. Only one hour of spare time a day at home and we teach you the basic training. You will find every lesson packed full of interest. Student S. F. McNaughton, Chicago, says, "Your lessons are like a romance, and what is more, after one reading the student gets a thorough understanding." Men who have had actual experience guide you carefully through your training. They select the lessons, lectures, blueprints, and bulletins. Once you start you can't get enough of it. Here are some real jobs. Which one do you want? Aeronautical Instructor, Aeronautical Engineer, Aeronautical Contractor, Aeroplane Salesman, Aeroplane Repairman, Aeroplane Mechanician, Aeroplane Inspector, Aeroplane Assembler, Aeroplane Builder.

Big Aviation Book FREE

Send coupon below for our new FREE book just out entitled, "Opportunities in the Airplane Industry." It is interesting and instructive. Get yours before edition is exhausted.

AMERICAN SCHOOL OF AVIATION
Dept. 1365. 3601 S. Michigan Ave., Chicago

AMERICAN SCHOOL OF AVIATION
Dept. 1365 3601 S. Michigan Ave., Chicago

Without any obligation send me your free book "Opportunities in the Airplane Industry," also information about your Home Study Course in Practical Aeronautics.

Name.....
Address.....
City..... State.....



ELECTRICAL EXPERTS IN DEMAND

Good positions await trained men
Salaries of \$12 to \$30 a day not unusual

THE ELECTRICAL field needs men. It needs them badly. Hardly a week or month passes but what some new use for electricity is discovered. Each new use means new positions—better positions—for men who have trained themselves as experts in this wonderfully fascinating work.

Why don't you study electricity and prepare for a good position at a good salary?

You can do it right at home in spare time through the International Correspondence Schools. Best electrical home-study courses ever offered. Endorsed by Edison and Steinmetz. Successful students everywhere.

Mark and mail the coupon today
for descriptive booklet

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7690-D, Scranton, Penna.

Oldest and largest correspondence schools in the world
Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- | | |
|--|---|
| <input type="checkbox"/> ELECTRICAL ENGINEER | <input type="checkbox"/> CHEMICAL ENGINEER |
| <input type="checkbox"/> Electrician | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Electric Wiring | <input type="checkbox"/> SALESMANSHIP |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> ADVERTISING MAN |
| <input type="checkbox"/> Electric Car Running | <input type="checkbox"/> Window Trimmer |
| <input type="checkbox"/> Heavy Electric Traction | <input type="checkbox"/> Show Card and Sign Painter |
| <input type="checkbox"/> Electrical Draftsman | <input type="checkbox"/> RAILROAD POSITIONS |
| <input type="checkbox"/> Electric Machine Designer | <input type="checkbox"/> ILLUSTRATOR |
| <input type="checkbox"/> Telegraph Expert | <input type="checkbox"/> DESIGNER |
| <input type="checkbox"/> Practical Telephony | <input type="checkbox"/> BUSINESS MANAGEMENT |
| <input type="checkbox"/> MECHANICAL ENGINEER | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Business Correspondent |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> BOOKKEEPER |
| <input type="checkbox"/> Toolmaker | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> Gas Engineer | <input type="checkbox"/> Cert. Pub. Accountant |
| <input type="checkbox"/> CIVIL ENGINEER | <input type="checkbox"/> Traffic Management |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Commercial Law |
| <input type="checkbox"/> Mining Engineer | <input type="checkbox"/> GOOD ENGLISH |
| <input type="checkbox"/> ARCHITECT | <input type="checkbox"/> STATIONARY ENGINEER |
| <input type="checkbox"/> Architectural Draftsman | <input type="checkbox"/> CIVIL SERVICE |
| <input type="checkbox"/> Architects' Blue Prints | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> PLUMBING AND HEATING | <input type="checkbox"/> Textile Designer or Supt. |
| <input type="checkbox"/> Sheet Metal Worker | <input type="checkbox"/> AGRICULTURE |
| <input type="checkbox"/> Navigator | <input type="checkbox"/> Poultry Raising |
| | <input type="checkbox"/> Automobiles |
| | <input type="checkbox"/> RADIO |

Name _____ 4-30-24
Present Business
Occupation Address
Street
and No. _____
City _____ State _____



Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following Cartoonist Evans' Simple and Easy to Learn Method and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the Portfolio of Cartoons and full details about the course. It is not expensive.

THE W. L. EVANS SCHOOL OF CARTOONING
825 Leader Building Cleveland, Ohio

The Army and Your Boy

(Continued from page 27)

the example of his comrades, he entered into the life of the camp with zest. He left camp a remade man, and when the camp opened last year he was almost the first one to enroll. In one short year he had accomplished more than he had in the rest of his life, for he was making a conspicuous success as a salesman and was almost ready to embark in business for himself. To him his first sojourn in a summer camp was the turning point in his life.

"Cases like these, and they are legion, make the summer camps well worth the money they cost the Government and the effort they cost the army officers who conduct them. They supply one reason, too, for the success of the camps, for men who have been benefited by them are bound to tell others and instill in them a desire to attend. For the last few years, almost twice as many as can be accommodated have applied for admission to the camps."

THE citizens' military training camps offer four courses of instruction—the basic, or first year, course, for which no military experience is required, and then the Red, White and Blue courses, which give graduates of the basic course progressive training for the various arms of the military service. A candidate who completes the Blue course may be commissioned a second lieutenant in the officers' reserve corps.

The basic course has a minimum of military training and a maximum of athletics and recreation. It is open to men between the ages of seventeen and twenty-four years, who are American citizens or who have taken out their first naturalization papers, and who are of good moral character. They must be physically fit, but the requirements are lower than the regular army requirements.

A month in a citizens' military training camp costs you nothing. The Government pays your railroad fare from your home to the camp, and back. Uniforms are provided. Bedding, food, laundry and medical attendance all are free. All you need is a modest supply of spending money.

Let's take a swift glance at a typical day in a "basic" camp.

The bugle turns you out at a quarter of six in the cool of summer morning. Dressing, shaving, and tidying up quarters fill in the half hour until breakfast. And a good breakfast it is, for the War Department, realizing that growing youngsters who are getting lots of exercise and fresh air need plenty of good food, allows the camp authorities seventy cents a day for your rations, which is more than the regulars get. After breakfast, tents and company streets are put in apple-pie order for inspection.

AT HALF past seven, the real work of the day starts with a close-order infantry drill that lasts for three quarters of an hour. Close-order drill does more than teach you to get from here to there in certain formations. It teaches you how to manage hands and feet and head, and

how to obey promptly without stopping to argue about it. A perfectly performed "squads right" may bring a thrill to the heart of no one but a drill sergeant, but it's a lesson in teamwork. And teamwork is as valuable out of the army as in it.

There is a ten minute rest after the drill, then a lecture for three quarters of an hour on citizenship. Next come twenty minutes of snappy calisthenics, after which you're content to sit down and listen to a lecture on hygiene. This is followed by a talk on military tactics—and then it's time for another meal.

TWO hours of every afternoon are set aside for sports. You are encouraged to bring your baseball, tennis, and swimming equipment to camp, for you must play some game. You may pick your own sport, but if you have no favorite you must take part in group games. All the camps have facilities for swimming, which is carefully supervised. The men always swim in pairs, so that no one ever is alone in deep water. More teamwork! Sport contests between companies arouse tremendous rivalry.

Rifle shooting is a military exercise that has much recreational value. Americans like to shoot, and every American is confident that he has an inborn ability for handling a rifle. Sometimes this confidence disappears after a half hour on the rifle range, but many of the candidates make remarkably good scores.

After the period for athletics comes the "high hat" event of the camp day—retreat. The companies drawn up on the parade ground present arms while the band plays the "Star Spangled Banner" and the flag flutters slowly down the staff.

Then it's time for another meal.

Your evenings are your own, provided you are back in camp by half past nine. Musical instruments are encouraged, and song is a universal habit. Taps sounds at ten o'clock, but there are usually few awake to hear the last call's long-drawn notes.

After a month of that sort of life, a fellow has just got to feel fit!

THE United States is divided for military purposes into nine corps areas. Each of these areas will have its citizens' military training camps this summer. Their dates for opening vary slightly, but most of the camps will be held in August. Forty-four camps, scattered from the Canadian to the Mexican border and from the Atlantic to the Pacific, will receive the 35,000 young Americans who will benefit from a month of healthful outdoor life under expert supervision.

If you decide that you want to be one of these 35,000, you had better act promptly. Write to the C.M.T.C. officer, at the headquarters of your corps area, for an application blank. The local recruiting officer will tell you how to address your letter. Applications are accepted in the order in which they are received and approved. Last summer 57,000 men applied for the camps, but only 33,500 could be accepted.



BIG ACCIDENT

AT MAIN AND BROADWAY

If you were a newspaper reporter, how would you describe this accident for your local newspaper? Have you a nose for news?

Be a Newspaper Writer

Interesting work that pays well! Something new every day! Here, there, everywhere that something is happening. Meeting the biggest people all the time. Happy, adventuresome days associating with clever men and women who live. That's newspaper work! Attending free all sorts of interesting meetings and banquets. Reviewing the new movies and shows for your paper. Getting the choice seats at the ball games, at boxing and wrestling matches, at the racing stadiums, at the football games! Interviewing stars of the stage and screen. Your name printed over your articles so friends will know and admire your cleverness. Is that a life?

Big Demand for Men and Women Who Can Write Experienced successful writers earn from \$3,000 to \$50,000 a year. Editors in nearly every state want us to recommend trained men and women for positions.

Have Your Writing Ability Analyzed Free Our Writing Ability Chart tests your natural talent for newspaper writing and also for general Writing for Profit. Our experts make a free report on your ability.

Learn to Write Like New York Reporters You learn the actual writing methods used by New York newspaper writers through our new home study course. Send for the Writing Ability Chart today. Use coupon.

Newspaper Institute of America

Approved as a Correspondence School
Under the Laws of the State of New York
25 West 45th Street, New York, N. Y.

Newspaper Institute of America, Dept. 41
25 West 45th Street, New York.
Send your free Writing Ability Chart, and further information regarding the opportunities in Newspaper Writing and general Writing for Profit.

Name.....
Street.....
City..... State.....
Occupation.....

OPPORTUNITIES IN Traffic Management

Become a Traffic Expert

The opportunities in traffic management are limited only by the boundaries of the business world. The trained traffic man is in demand by transportation systems and by industrial organizations.

Three Detroit Firms Pay Their Traffic Managers Over \$20,000 a Year

Prepare for this growing, profitable profession at home in your spare time under supervision of traffic experts. Low cost; easy terms. Thru the LaSalle Problem Method you learn by doing. Valuable 64-page booklet free. **This Book FREE!** Send for it NOW.

LaSalle Extension University, Dept. 583-T Chicago



For Vaudeville, Club, Lodge, School, and Parlor Entertaining, is easily learned by the Balda Method. Send \$1.00 for Beginner's Instructions with Laugh Producing Program of 23 Comic Trick Drawings. Catalog of Chalk Talk Programs and Supplies Free. **BALDA ART SERVICE** Dept. 7, Oshkosh, Wis.

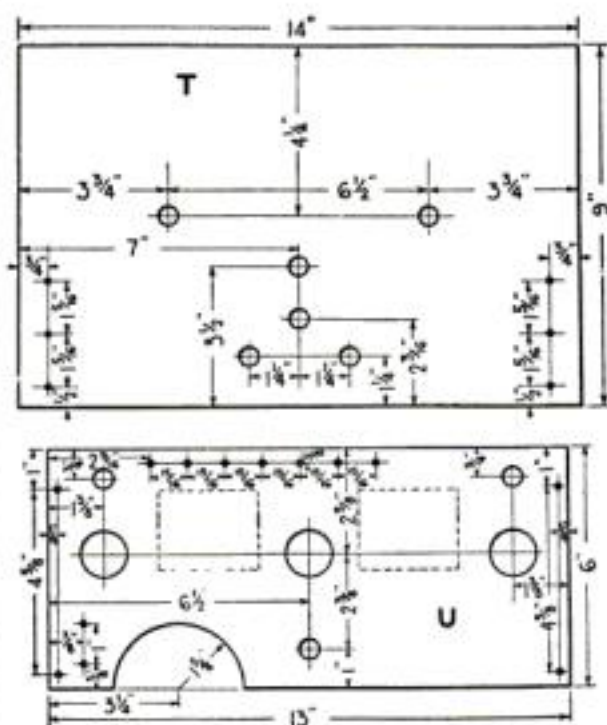
A 2c STAMP—

will start you on the road to success. See Money Making Opportunities on pages 116 to 142.

Radio Builders Win Prizes

(Continued from page 61)

No. 5 to No. 4 and continue it around past binding post No. 2 and filament switch *S*, and connect the end of it to the rotary plate terminal of condenser *D*. Run branches from this wire to binding post No. 2, the upper end of coil *A*, the lower end of coil *B*, and one terminal of filament switch *S*. Now run a wire from the remaining terminal of filament switch *S* to one filament terminal of each of the



Figs. 5 and 6. Front panel and sub-panel layouts. It might be necessary to alter arrangements somewhat to suit the parts you use

sockets *L*, *M*, and *N*. It makes no difference which filament terminal you choose. Connect one end of coil *C* to this wire at the nearest point.

Connect binding post No. 3 with No. 8 and run branches from this wire to one terminal of each of the rheostats *H*, *J*, and *K*. Then connect the remaining terminal of each rheostat to the remaining filament terminal of the socket nearest to it. Note that the center socket *M* is connected to rheostat *J*, which is mounted on the front panel *T*.

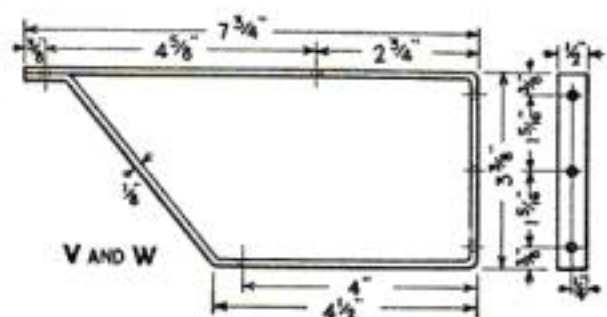


Fig. 7. The sub-panel brackets. This design is correct for vertical panel mountings. If you build your set with a sloping-panel cabinet, you will have to bend the brackets to correct shape

You have now completed the filament wiring, and it would be a good idea at this point to insert the tubes in the sockets, connect up the *A* battery and see if the filament switch *S* and the rheostats *H*, *J*, and *K* all work properly.

Next connect the top end of coil *B* with the terminal on the stationary plates of variable condenser *D* and run a branch from this wire to the nearest terminals of grid condenser *E* and grid leak *G*. The other two terminals of condenser *E* and grid leak *G* should be connected together and to the grid (Continued on page 140)

Great Inventors Now Teach You How to Invent

Edison Says Invention is a Science and Should be taught as a Profession

Thousands of inventions are needed today. Just one little idea can bring you fortune and fame. The world is waiting for new inventions in engineering, chemistry, household articles,



Raymond F. Yates

radio, and other fields—and will pay big money for even the simplest idea. Little things like the tin bottle cap, the crimped hair-pin, the rubber on the end of a pencil brought their inventors hundreds of thousands of dollars.

Couldn't you make some equally simple invention? Haven't you ideas that could be turned into money? Inventing isn't a matter of blind luck—it isn't a question of guesswork. Invention is based on certain principles, just as any other profession. It follows a definite course of procedure step by step from the origination of the first idea to its final development on a commercial scale.

Learn at Home in Spare Time

Hitherto, every inventor had to work out these principles of invention for himself. For every successful inventor knows and uses these principles. He knows WHAT TO INVENT and HOW TO INVENT. But now you can learn in a few months what it took great inventors years of discouragement and terrific struggle to acquire.

Raymond F. Yates, who, with fourteen other famous inventors, has now revealed, for the first time, the secrets of invention. They explain how to originate ideas, how to develop and perfect your ideas, how to patent your inventions, and how to sell them to your best advantage. In short, they make it amazingly easy for you to become an inventor, simply by learning the whole wonderful science of invention, step by step, from beginning to end. It requires just fascinating moments of your spare time at home.

First Course of Its Kind

This is the first course in practical invention that has ever been devised. Now you can take Edison's advice and actually learn HOW TO INVENT—how to make invention a profession. In simple, easy-to-understand language, you are told how successful inventors work; you learn how to use the secrets of invention that convert a simple little idea into money.

FREE! New Book on Inventive Science

A book has just come from the press that tells all about this new course in the Science of Invention. This book will be sent to you free if you are inventively inclined, or if you have some idea in mind for an invention. We cannot afford to send this book to those who are merely curious or to children. If you are genuinely interested, however, be sure to send for this book today. Write your name and address on the coupon below or send a postcard NOW!

Bureau of Inventive Science

Dept. 25, Wisner Bldg., Rochester, N. Y.

Bureau of Inventive Science, Dept. 25
Wisner Building, Rochester, N. Y.

Please send me your free book, "The Science of Invention."

Name.....

Address.....

City..... State.....

CHICAGO TECHNICAL COLLEGE

**Drafting
Engineering
Electricity
and Architecture**

[23rd Year]

A MAXIMUM of practical training in a minimum of time is offered you by one of "America's oldest and largest schools of specialized engineering" ... technical training of college standard for men who have neither the time, money nor preliminary education to attend a university. Over 1000 men enroll each year in day and evening classes.

Short, Intensive Training

of a very practical sort trains you for a high salaried position. Many of our students are assisted to responsible positions before graduation ... they earn while they learn.

Chicago Technical
College Bldg.



If you can't come to Chicago STUDY AT HOME

Ten months from today you can be a trained draftsman...at high salaries. Enter a profession, without sacrificing time. Study

DRAFTING
In your spare time...We have been giving technical training for 23 years...Instructors are experts, the same instructors as in the resident school.

FREE TRIAL LESSON
To see how much you will like this high-grade profession, and

FREE OUTFIT
a regular \$25 draftsman's outfit is included in the price of the course.

Send for 40-Page Book
of facts about drafting...send for it...free. Write today for the Free trial lesson in drafting, sample drawings made by students and the book of information. Address Dept. 531.

Courses are arranged to suit your needs: 2-year diploma; 3-year B. S. degree; special short courses adapted to the individual. Instructors are experts, actively at work in the very professions they teach. Tuition is low, terms easy. Enter any time.

Write for Free 72-Page Blue Book
It tells about the courses (full descriptions); about the great demand for Chicago Technical College trained men; about college athletics and other interesting facts you'll want to know. Send for the Blue Book now, without obligation! Address

Chicago TECHNICAL College
Dept. 58 118 East 26th St., Chicago

Learn Photography at HOME

Many earn \$3,000 to \$10,000 a year. Prepare quickly during spare time. Also earn while you learn. New easy method. Nothing else like it. Send at once for free book, "Opportunities in Modern Photography" and full particulars. Special offer open now.

INTERNATIONAL STUDIOS, Inc.
Dept., 1365 3601 Michigan Ave., Chicago, U. S. A.

AUTO INVENTIONS WANTED

Long established manufacturer of auto accessories which are daily sold by practically all wholesale and retail accessory houses will consider manufacturing and distributing new automobile products, capable of equally wide sale through same channels. Patented articles preferred. Address Auto Accessory Manufacturer, Room 2104, 310 S. Michigan Ave. Chicago, Ill.

Radio Builders Win Prizes

(Continued from page 139)

binding post of socket *M*. Now connect the *P* binding post of socket *M* with one terminal of fixed condenser *F* and the *P* terminal of audio transformer *O*. Connect the remaining terminals of condenser *F* and coil *C* together.

The *B* plus terminal of transformer *O* should be connected to binding post No. 6, and the *G* terminal of the transformer should be wired to the *G* binding post of socket *L*.

Now connect the *P* binding post of socket *L* to the upper lug of jack *Q*; the

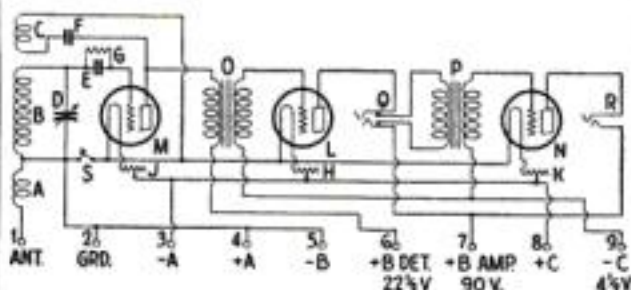


Fig. 8. Theoretical wiring diagram. You will find pictorial wiring diagram on page 61

second lug on this jack with the *P* terminal of transformer *P*; and the third lug with the *B* plus terminal of the same transformer. Run a wire from the bottom lug of jack *Q* to the bottom lug of jack *R* and continue it over to binding post No. 7.

Next connect the *G* terminal of transformer *P* with the grid binding post of socket *N* and connect the plate binding post of this same socket to the remaining terminal of jack *R*.

Complete the wiring by connecting the *F* minus terminals of transformers *O* and *P* together and run a branch from this wire to binding post No. 9.

THERE are two good ways to fasten the receiver into the cabinet. You can drill holes in each corner of the front panel *T*, using wood screws, or you can bolt the receiver into the cabinet by drilling holes through the bottom of the cabinet and the lower arm of each of the sub-panel brackets *V* and *W*. The latter method was used on the prize set and is excellent because it eliminates the extra screws on the front of the panel. It can be done conveniently only if there is sufficient space inside the cabinet at each end so that you can use a screw driver.

To put the receiver into operation, connect up the antenna and batteries as shown. Turn on filament switch *S* and adjust rheostats *H*, *J*, and *K* until the tubes glow dimly. The dial should be mounted on the shaft of condenser *D* so that it reads 100 when the plates are fully engaged. Turn the dial on the shaft of coil *C* until a click accompanied by a slight hissing noise is heard. Then turn it back until the noise stops and turn the dial on condenser *D* until you hear the broadcasting from some station. Immediately stop turning the dial and adjust all the rheostats to the lowest glow in the tubes that will give you full signal strength. Readjust both dials until the signal is as loud and clear as possible. You must be absolutely sure that you always operate (Continued on page 141)

PRACTICAL BOOKS

THAT WILL

RAISE YOUR PAY

WRITTEN in easy-to-understand non-technical language these books will help you in your chosen trade. Every book is an entire course of instruction condensed into one volume. Thousands of men have used them to increase their pay. You will find them full of information and ideas that will help you raise your pay.

Painting and Decorating

Ross Crane Book of Home Furnishing and Decoration.....Cloth	\$3.00
House Painting Methods with the Brush and Spray Gun, by Vanderwalker.....Cloth	\$2.00
Interior Wall Decoration, by Vanderwalker.....Leatherette	\$4.00
The Mixing of Colors and Paints, by Vanderwalker.....Cloth	\$2.00
A Show at Show Cards.....Cloth	\$4.00
Sign Painting, by Atkinson.....Cloth	\$4.00
Strong's Book of Designs.....Leatherette	\$4.00
Modern Painter's Cyclopaedia.....Cloth	\$2.00
Automobile Painting.....Cloth	\$1.50
New Hardwood Finishing.....Cloth	\$1.50

Steam Engineering

Swingle's Handbook for Steam Engineers and Electricians.....Leatherette	\$4.00
Examination Questions and Answers for Marine and Stationary Engineers.....Leatherette	\$2.00
Steam Boilers.....Leatherette	\$2.00
Swingle's Catechism of Steam, Gas and Electrical Engineering.....Leatherette	\$1.50

Carpentry Books

Cloth Binding

Modern Carpentry, 2 vols.....	\$3.00
The Steel Square, 2 vols.....	\$3.00
Modern Estimator.....	\$1.50
Timber Framing.....	\$2.00
Builder's Architectural Drawing.....	\$2.00
Concrete.....	\$1.50
Practical Bungalows.....	\$1.00
Roof Framing, by Van Gasbeek.....	\$1.50

Electrical Books

Telephony, Including Automatic Switching, by Smith, 450 pp.....Leatherette	\$2.50
Practical Applied Electricity.....	\$2.00
Wiring Diagrams and Descriptions.....	\$1.50
Armature and Magnet Winding.....	\$1.50
Electric Motors, D. & A.....	\$1.50

CHECK

—the books you want and mail today with your remittance.

We will send you the books you order on our guarantee that if you are not thoroughly satisfied with them we will return your money.

POPULAR SCIENCE MONTHLY
250 Fourth Avenue
New York

Popular Science Monthly

Gentlemen:

Please send me the books I have checked for which I enclose my remittance of \$..... I am ordering these books on the basis that if I am not satisfied my money will be refunded.

Name.....

Address.....

Radio Builders Win Prizes

(Continued from page 140)

your receiver so that it does not oscillate.

The best antenna for use with this set is a single wire about 100 feet long and as high as possible. If you are located where an antenna of this length is impossible, use the longest antenna your local conditions will permit; and then if the broadcasting seems weak or the receiver tunes too sharply, increase the number of turns in coil A until you strike the right balance between selectivity and ability to bring in stations with volume.

If you run into any difficulties either in the construction of the set or in getting it to operate properly, first check up your wiring very carefully, then make sure that your batteries and tubes are good. Then, if you are still unable to locate the trouble, write to the Radio Editor of POPULAR SCIENCE MONTHLY, and be sure to state your troubles as fully as possible.

Power for the Holy Land

AMONG many schemes for the development of Palestine is one for utilizing the Dead Sea, which is about 1300 feet below sea level, as a source of water power. The plan, while startling, is not theoretically impossible, it is claimed by its proponents. If, it is argued, power can be obtained from water running down to the ocean, it could likewise be taken from water coming in from the ocean, if there is a lower basin to receive it and an outlet for the surplus.

The Dead Sea provides the basin, and the sun which drinks up the River Jordan as fast as water runs in, engineers say, would draw up enough water from the Dead Sea to prevent a possible overflow. This scheme would provide over 600,000 horsepower for the electrification of the Holy Land.

A Monkey Experiment

MONKEYS in cages are generally saucy, ill-mannered beasts. Professor Pfungst, of the Berlin Physiological Society, thought that this was due, perhaps, to association, and determined to raise a monkey without any monkey companions. The monkey was well-mannered from birth. For four years he saw practically no other creatures except man. He could not bear being shouted at or stared at. He yawned when angry. He never laughed nor cried.

Then he was introduced to another monkey. At first he was afraid, but his courage gradually increased and soon he was like his companions.

Proper Food Lessens Disease

THE connection which exists between a faulty diet and disease is well illustrated by the Arabs. Dr. Hindhede, the best-known food expert in Denmark, declares. The Arabs in the desert live largely on figs, dates, vegetables and a little milk. Meat is eaten rarely.

Despite the filth in which they live, they are more immune to disease than Europeans, he says. But when these Arabs desert their dirty villages for the towns, to live like Europeans, eating the food Europeans do, they become susceptible to all the diseases to which Europeans are subject.



Amazing New Facts About Old Age

"Did you know that two-thirds of all men past a certain middle age suffer with a certain seldom mentioned disorder?"

"By the medical profession this is known as hypertrophy of the prostate gland. And scientists have now revealed that it is directly responsible for much of what many people mistake for actual old age."

NEW HYGIENE

But no longer should men approaching or past the prime of life put up with these painful and embarrassing conditions due to this cause. For a well known American scientist has discovered a new, safe home treatment for this gland trouble—a new kind of hygiene that goes right to the seat of this trouble, often bringing new pep and vigor to the entire body.

MIDDLE AGE AILMENTS

Here is usually quick relief for such distressing ailments as sciatica, aches in back, legs and feet,

nervousness and irritability, when due to enlarged prostate.

Twenty thousand men testify to the value of this treatment.

FEEL TEN YEARS YOUNGER IN SIX DAYS OR PAY NOTHING

So successful have been the results of this new hygiene in thousands of cases that the discoverer offers to send it to any man under the amazing guarantee that unless you feel 10 years younger in 6 days you pay nothing. There are no drugs to swallow—no exercises, diets or lessons.

ALL EXPLAINED IN FREE BOOK

If you are troubled with any of the disorders mentioned, if you have chronic constipation or this trouble, you should send for a vitally interesting free book, written by this scientist called, "Why Many Men Are Old At 40." It describes this splendid treatment and shows how you may often regain much of your youthful vigor and be free from certain disorders. No obligation. Simply fill out and mail the coupon below.

W. J. KIRK

4057 Main Street Steubenville, Ohio

MR. W. J. KIRK

4057 Main Street
Steubenville, Ohio.

Send me free, without obligation, your booklet, "Why Many Men Are Old At 40."

Name

Address

City State

Western Office: Dept 40-Z, 711 Van Nuys Bldg.,
Los Angeles, Calif.

A Test Every Man Past 40 Should Make FREE



The coupon herewith will bring you FREE a vitally interesting booklet which will enable you to ask yourself certain questions which show you the true state of your physical condition. Fill out and mail the coupon immediately.

The Electrician's Wiring Manual

By F. E. SENGSTOCK, E. E.

Contains all the information needed for the proper installation of lighting and power systems in houses and other buildings.

It completely covers inside electrical wiring and construction in accordance with the National Electric Code.

Pocket size—flexible binding

448 pp.

Price, \$2.50

POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York City



LEARN CARTOONING At Home—It's Easy

Just think—\$50 to over \$250 a week paid to good cartoonists for work that's fun! And YOU can easily learn cartooning at home—no matter if you've never touched a drawing pencil. Write for interesting FREE Book describing our easy simplified method. Also details of special Outfit Offer! Send postcard today to Washington School of Cartooning, Room 245-D, 1113—15th Street, N. W., Washington, D. C.

Here's Work That is Almost ROMANCE!



Many EARN \$50. to \$250. a Week in RADIO

Get into the great new BIG-Pay Industry—Radio. If you're earning a penny less than \$50 a week, clip coupon now. Send for AMAZING FREE BOOK. Be a Radio Expert, and draw down big money for the easiest and most fascinating work in the world. Positions everywhere. Need for Radio Experts in every community. Short hours. BIG PAY. Free book gives all the facts.

Learn Quickly and Easily at Home

Master Radio Engineers will show you how to qualify, quickly and easily at home, for Radio's fine jobs. We guarantee to train you successfully. Every day N. R. I.-trained men are taking good places in the Radio field. Thousands of openings now awaiting the trained man. FREE EMPLOYMENT SERVICE. Many other big features. Get the facts—CLIP COUPON.



"My charges for consultation \$2.50 per hour. All success due to you."
R. W. Blackhill,
Brooklyn



"Radio a gold mine—your course worth thousands."
A. R. Herke,
Winnipeg.

Get This Free Book!

Send coupon below for FREE BOOK—"Rich Rewards in Radio." Read for yourself. No previous experience needed. Common schooling enough. WRITE NOW.



Receiving sets, from the simplest kind to thousand mile receiver, included to help you learn. An UNEQUALLED OFFER. Other special features for limited time only, so Act Quick!

NATIONAL RADIO INSTITUTE
Dept. ET-9, Washington, D. C.

MAIL COUPON

National Radio Institute,
Dept. ET-9, Washington, D. C.

Without obligating me in any way, please send me your free book, "Rich Rewards in Radio," also complete information on your practical, home-study Radio course.

Name.....Age.....

Address.....

Town.....State.....

How to Pick the Best Car in Its Class

(Continued from page 66)

be sure that the brake and clutch pedals work easy. It doesn't make much difference whether Grace can reach the pedals or not. You can fix that by putting a cushion behind her back. In fact, it would be better to pick a car with plenty of leg room so you won't feel cramped on long drives."

"What's the dope on overhead valves, uncle? Are they really much better?"

"THEORETICALLY they are—all the racing cars use them," replied Gus. "But in a car for ordinary use I can't see that there's much advantage. They may result in a slight saving of gasoline as compared with the ordinary valves that are placed in a pocket beside the cylinder head. Also, with overhead valves, you can take the cylinder head off and remove it to a warm place in the cellar when you want to grind the valves instead of working in a cold garage. On the other hand, overhead valves usually are noisier, and as there are more parts in the valve mechanism, there is more to replace when things begin to wear."

"Humph!" exclaimed Henry. "It sure is a hard job to pin you down to a definite opinion as to what is really the best!"

Gus smiled.

"For the darn good reason, son, that there isn't any such thing as best. The fact that there are so many different ways in which gasoline motors are made shows that the designers can't agree. Whenever there are two ways to make a piece of machinery, there are always good arguments for either way, and you'll have to decide for yourself which of these ways fits in best with your way of doing things."

"Do you think a car with four-wheel brakes is safer, uncle?" questioned Henry as he stooped down to inspect the front-wheel brakes on one of the exhibition cars.

"DON'T worry your head over four-wheel brakes," advised Gus thoughtfully. "I've fixed a powerful lot of brakes, and as far as I can see, there isn't much in this four-wheel business as compared with one real good pair of brakes on the rear wheels. Four-wheel brakes are fine in theory, but durned few of the outfits that I've looked over were working right, and on the low-priced cars I'm inclined to think that their disadvantages just about make up for their advantages."

"They say you can stop quicker with 'em," Henry argued.

"You can if they are adjusted right; but you have to be careful not to have the front-wheel brakes too tight or they might lock if you jammed on the brake pedal too hard. And if the front wheels lock, son, you are mighty likely to get into a nasty front wheel skid. Mind you, I'm not suggesting that you don't buy a car with four-wheel brakes. The point is, I wouldn't consider them a feature that would influence me to buy some particular make of car that was no better in other ways than another that did not have them."

"Those wheels look pretty solid," observed Joe as he directed their attention to a sedan equipped with disk wheels.

"Sure they're solid," grunted Gus.

"Why shouldn't they be—made of metal the way they are? As far as I can see, about the only advantage of disk wheels is that you can keep them clean easier than the wood wheel. On the other hand, you have to take your wheel off or else crawl under the car every time you want to adjust the brake bands. You can't work between the spokes as you can with wood wheels."

"But, uncle, they look so spiffy!" urged Grace.

"AND we've just got to be stylish!" observed Gus sarcastically. "All right, Henry, let her have the disk wheels if she thinks them classy. You can take the extra amount out of her allowance!"

"That's not fair," said Grace, pouting. "Get your old wood wheels if you think they're just as good."

Henry was collecting catalogs right and left. "I'm going to study these over mighty carefully when we get home," he said, as he vainly attempted to stuff another large folder in a pocket that was already crammed full.

"That's a good idea," Gus agreed. "While you're here, you and Grace had better sit behind the wheel of every car in your price class so as to get a line on whether there's enough leg room. Work the pedals, and see if the gear shift lever is handy. Watch out for any car that has a gear lever that slides up under the dash when you go into reverse. It'll take all the skin off your knuckles if you have to back up in a hurry."

"Suppose Joe and I leave you now for a while," Gus concluded. "We want to look over some of the accessory exhibits. We'll meet you at the door in about three quarters of an hour."

"Why can't we look over the accessories, too?" asked Henry.

"Nothing doing!" Gus ordered. "You stay away from the accessories or you'll end up by fitting that new car with more junk than it will carry. No, sir! All you need in the way of accessories—at least to start with—are front and rear bumpers, a rear vision mirror, a windshield wiper and a spare tire!"

"I DON'T want to butt in, Gus," said Joe when the young couple were out of hearing. "but it kind of seems to me that it would be a good idea if Henry bought a second-hand car. He barely knows how to drive, and Grace never even has learned how. They are bound to do a lot of rotten gear shifting, and the chances are that they will run into a lot of minor accidents the first year. And if they're going to bust things up it might better be a second-hand outfit."

"That's all true," said Gus. "At least it would be in any ordinary case. But Henry is careful and he's the kind of a bird who can't seem to take pride in anything unless it's just right. He'll take much better care of a new car than he would of an old one. Besides, if he got a second-hand car, I'm afraid the Model Garage would have to do a lot of free repair work this year!" he concluded with a chuckle.

This One



4FZP-6X5-T4D1

Here Are Correct Answers to Questions on Page 43

1. The heart tends to keep time with any strong rhythm that you hear. Ordinarily one's heart beats about seventy times a minute. The rhythm of a fast march makes your heart beat a little faster, the faster heartbeat improves circulation and makes you feel more active.

2. Alcohol was used a good deal, also the juices of certain plants like opium. The ancient Egyptian surgeons had a way of hitting the patient on the head in just the proper place and then operating while he was unconscious from the blow.

3. It is water which has been turned into steam and then condensed into water again. The process leaves behind some of the impurities which cannot be turned into steam. The distilled water is therefore purer.

4. Many of the sun spots remain for weeks in about the same place on the sun's surface. We can see these spots move as the sun turns around on its axis.

5. Yes. It attracts the water just as the moon does, but less strongly, because it is so much farther away. Even the other planets have an attraction on the water and affect the tides.

6. Froth is made up of thousands of tiny air bubbles each one surrounded by a film of white of egg. White of egg makes a better froth than water because it is tougher than water and the films around the air bubbles in the froth do not break so easily.

7. When a wave rushes up the beach and breaks, the water has to run back into the ocean. Meanwhile another wave climbs on top of the water running back. On the top of the water you see a wave advancing toward the shore, underneath there is a seaward-flowing current of the water belonging to the previous wave.

8. First he surrounds himself with a protective coating woven like a spider web, called a cocoon. Inside this all his internal organs disappear. His body becomes a mere lump of matter in which the beginnings of the body of the butterfly appear slowly. Finally, the butterfly is complete, it pierces the cocoon and comes out. Just what produces this mysterious change inside the cocoon is still one of the great mysteries of science.

9. The flax stalks are placed in running water where they disintegrate so that the fiber from which linen is made can be removed. This disintegration is caused by bacteria. Without it the fiber cannot be separated from the stalk, and without the fiber, linen itself would be impossible.

10. When we eat more salt than we need, too much gets into our blood. This excess has to be washed away. Thirst is a sign that the body needs more water for this purpose.

Dangerous Reading

Beatrix as she is conceived by the English artist, Hugh Thomson



Would You Enjoy a Lunch with Beatrix?

Beautiful Beatrix, immortal in fascination, irresistible in mysterious feminine appeal—with a touch of the devil. If she came to your town, would you invite her to lunch, if you had the chance?

Of course you would, and that luncheon would be history in your life, for Beatrix, Thackeray's heroine, is one of the most tantalizing women ever created.

Beatrix is not alone. There are dozens of these exciting women waiting for you.

You feel their presence in the room with you—electric, intoxicating. As if by magic they step out of the pages that hold them, to you. They are as alive as the girl you noticed on the street today. Hundreds of men have fallen in love with them.

You don't seek out the commonplace girl in real life. If women interest and delight you, don't be content with pale, dull heroines who are only imitations of the colorful great ones.

That is the endless pleasure of The Golden Book. There you are always sure of meeting the most wonderful women who ever sent a man's heart pounding. From all countries and all times are the women it would thrill you most to know. Meet them in The Golden Book.

AMONG THE CONTRIBUTORS TO THE APRIL ISSUE ARE:

W. Somerset Maugham	James Stephens
Georges Clemenceau	O. Henry
Stewart Edward White	Lafcadio Hearn
Joseph C. Lincoln	Baudelaire
Stacy Aumonier	Lewis Carroll
Robert L. Stevenson	Thomas Hardy

ANATOLE FRANCE was a writer unsurpassed in modern times. He says the beginning of education is being interested. You can't learn when you are bored. Hasn't your own experience taught you that?

How many people hate works of genius today because they were forced down their throats at a time when they found them dull? How many really great books and plays have been eternally spoiled for you because you were bored by them and had to read them at school, or from a sense of duty?

The truth is, whether a story was written last week or a hundred years ago—whether it is by a "classic" author or a widely-heralded best seller—if it is dull it is dangerous reading for the man and woman who have discovered what education means.

When you have laughed, wept or thrilled over one short story that is really good; when you have been absorbed in one truly moving book; when you have sensed life a little more keenly because of the winged words of one vivid poem, you have contributed more to your education than a man has received from scores of impressive volumes read from a sense of duty.

That is why



makes such an appeal to the reader who demands something interesting and at the same time enduring. From the vast storehouse of the world's classics, written perhaps this year, perhaps thousands of years ago, each month it offers you those great stories, poems, plays and adventures that remain great because they are alive today.

As the telephone, the automobile and the radio enable you to live more richly, this new and delightful magazine has been inspired by the modern spirit to give you the pure gold that genius has mined. From all countries and all times it brings you adventures into literature.

The charm of The Golden Book is like the charm of an exquisite bouquet, of a delightful meal—just the right selections relative to you and to each other. It is that indefinable thing—the personality of The Golden Book—that has brought in one year 200,000 devoted readers. It is really edited.

Offer for Readers with 20th Century Minds

Everyone who loves books that are interesting will see at once the dazzling possibilities of such a magazine.

In order that you may know yourself how stimulating The Golden Book can be, we have decided—for a little while only—to make a special offer to new subscribers. The regular price of The Golden Book is twenty-five cents a copy. We are going to send you two issues at our expense, and this is how. If you act at once we will give you The Golden Book for six months for \$1.00 instead of \$1.50. But—this is only for prompt action.

Simply fill out the attached coupon and mail it to us today. Do it now, while you are looking at it. This is only a temporary introductory offer to new subscribers. We cannot offer it long. We do not promise ever to make it again. Sooner or later you are going to become enthusiastic about The Golden Book if you enjoy reading fascinating stories. Send the coupon at once and be glad. Do not wait and be sorry.

Only One Prompt Dollar

P.S.M.
4-26

Introductory
Offer

6 Months for \$1

The Golden
Book Magazine

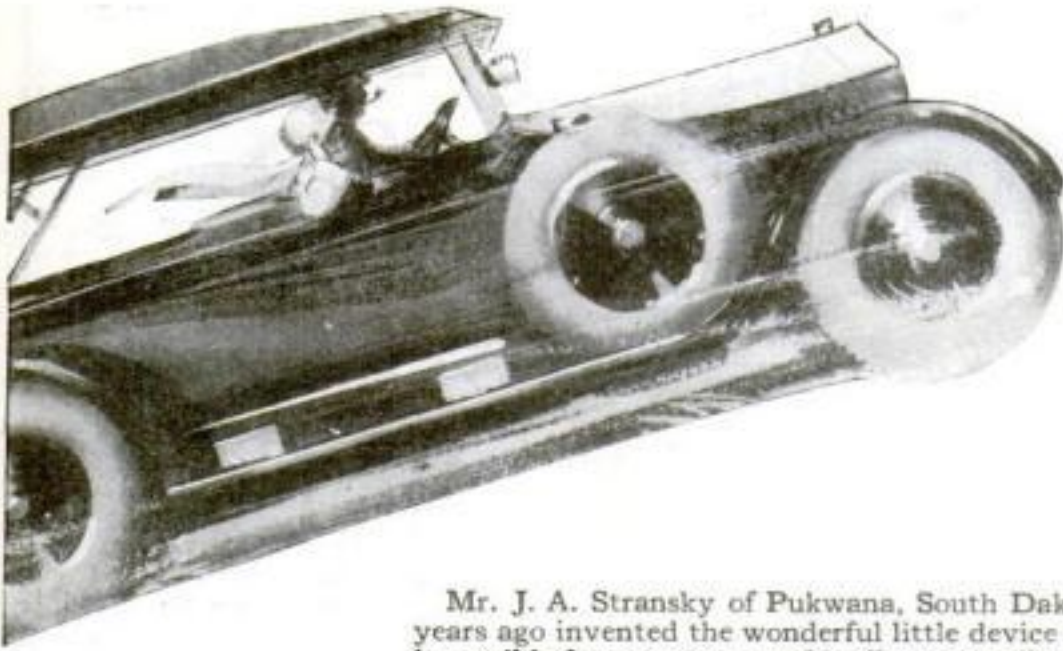
55 Fifth Avenue,
New York

Send The Golden Book
to the address below at
Special Introductory offer,
six months. I enclose \$1, in-
stead of the usual \$1.50.

Name.....

Street.....

City.....



Mr. J. A. Stransky of Pukwana, South Dakota, several years ago invented the wonderful little device which made it possible for an auto to go 61 miles on a gallon of gasoline! Since that time he has built up an immense business, shipping Stransky Vaporizers to all parts of the civilized world, and helping thousands of men to make enormous big incomes distributing this product.



Inventor Cuts Gasoline to 9¢ a GALLON!

Now you can cut your gasoline cost as low as 9¢ a gallon. An amazing new invention makes practically any car give twice its regular mileage to the gallon. Many run from 37 to 57 miles and up to 61 miles a gallon. This wonderful invention is the work of Mr. J. A. Stransky of Pukwana, South Dakota. Already it is being used by over a million satisfied car owners—on all makes and models of cars. And now the inventor will send you a sample at his own risk! Read his offer below. Many now

Earn \$250 to \$500 a Month!

Here is one of the biggest inventions of the century—an invention almost as revolutionary as the invention of the auto itself. This wonderful little device adds more power and mileage to a motor, reduces spark plug trouble, prevents overheating, makes engine start easier, and prolongs life of motor—and it's making fortunes for agents and distributors. You can easily earn astonishing big profits in full or spare time—many are earning \$250 to \$500 a month!

Here's how it works. Every carburetor is adjusted to make starting easier—it gives a rich mixture to start a cold engine. But once the engine gets heated up the mixture is far too rich. Half the gasoline is drawn into the cylinders in a raw state and instead of exploding, it burns. This causes a heavy deposit of carbon. But this startling little device changes all that. As soon as the engine warms up, this device, the Stransky

Vaporizer and Decarbonizer, automatically begins to admit a much larger volume of air, thoroughly vaporizing all the gasoline, giving it fully 50% more power—breaking it up so that it explodes instead of burning!

AGENT EARNS \$120 In One Day

I have found out that the Stransky will do what you said it would. I took forty orders in one day and wasn't out long. My Ford runs better than it ever did. I can save half the gas and it pulls better.—J. M. James.

\$48.00 in 3 Hours!—My gas bill has been cut nearly in half. I have removed every particle of carbon from my engine. Since I installed it, my engine runs as good as new, starts easier and quicker. I went out Saturday about 3 hours and secured 16 orders.—J. A. Williams.

Sold 32 to Yellow Taxi Co.—Yesterday I sold the Yellow Taxi Co. 32 vaporizers after they had tried one out for a week.—F. J. Manker, R. I.

\$51 in One Hour!—The results of one hour's work—17 men gave me orders for the Vaporizers.—J. W. Cronk.

—and there are 20 million of them—wants this splendid little device the instant he sees it. Just send the coupon for full details of our introductory sample offer. Mail it right now—today.

Introductory Sample Offer

To introduce this new invention Mr. Stransky, the inventor, will send a sample at his own risk. Write him at once for his proposition.

You can earn big money just telling your friends about this startling new device—in your spare or full time. J. M. James made \$120 in one day. Vernon Gaines netted \$94 in eight hours. The demand is enormous. Every auto owner in the country



This wonderful little device cuts the cost of gasoline in half by making practically any car give twice its regular mileage to the gallon—it made it possible for a car to go 61 miles on a gallon of gasoline!

Ford Runs 60 Miles On a Gallon

I made approximately 60 miles per gallon of gas in a Ford Sedan, as I made 15 miles on one quart of gas.—O. B. Zeigler, Pa.

32 Miles with Buick

Vaporizers installed on both Buick and Ford and are doing wonderful work, getting 32 miles on Buick and 51 miles with Ford.—Harvey C. Hipple, Pa.

Chevrolet Makes 43 Miles On a Gallon

We have tried them out. Ford got 40 miles out of a gallon of gas and Chevrolet got 43 miles.—F. S. Carroll, Ind.

J. A. STRANSKY MFG. CO.
E-730 Stransky Bldg. Pukwana, So. Dakota

J. A. Stransky Mfg. Co.
E-730 Stransky Bldg.
Pukwana, So. Dakota

Tell me how I can get samples of the Stransky Vaporizer at your risk. Also tell me how I can make from \$250 to \$500 a month.

Name.....

St. or R.F.D.....

City..... State.....



"The fragrance of pipe-smoke enchants me"
Alma Rubens

Guaranteed by
The American Tobacco Co.
INCORPORATED

It's fragrant
because it's



Quality created
the demand—
Demand made
possible the price

**NOW
12¢**



**"I'll take the
Chesterfields"**